the OIL AND GAS JOURNAL

FEBRUARY 6, 1956

New Round of Wage Hikes

Industry offers 6 per cent boost.
Unions still to be heard from

p. 54

What's ahead in

Nonmanual Welding

for pipelining?

p. 80

Four-article section on

DRILLING MUDS

Authors discuss a new centrifuge, additives, deep salt drilling, and what mud particles do to your pay.

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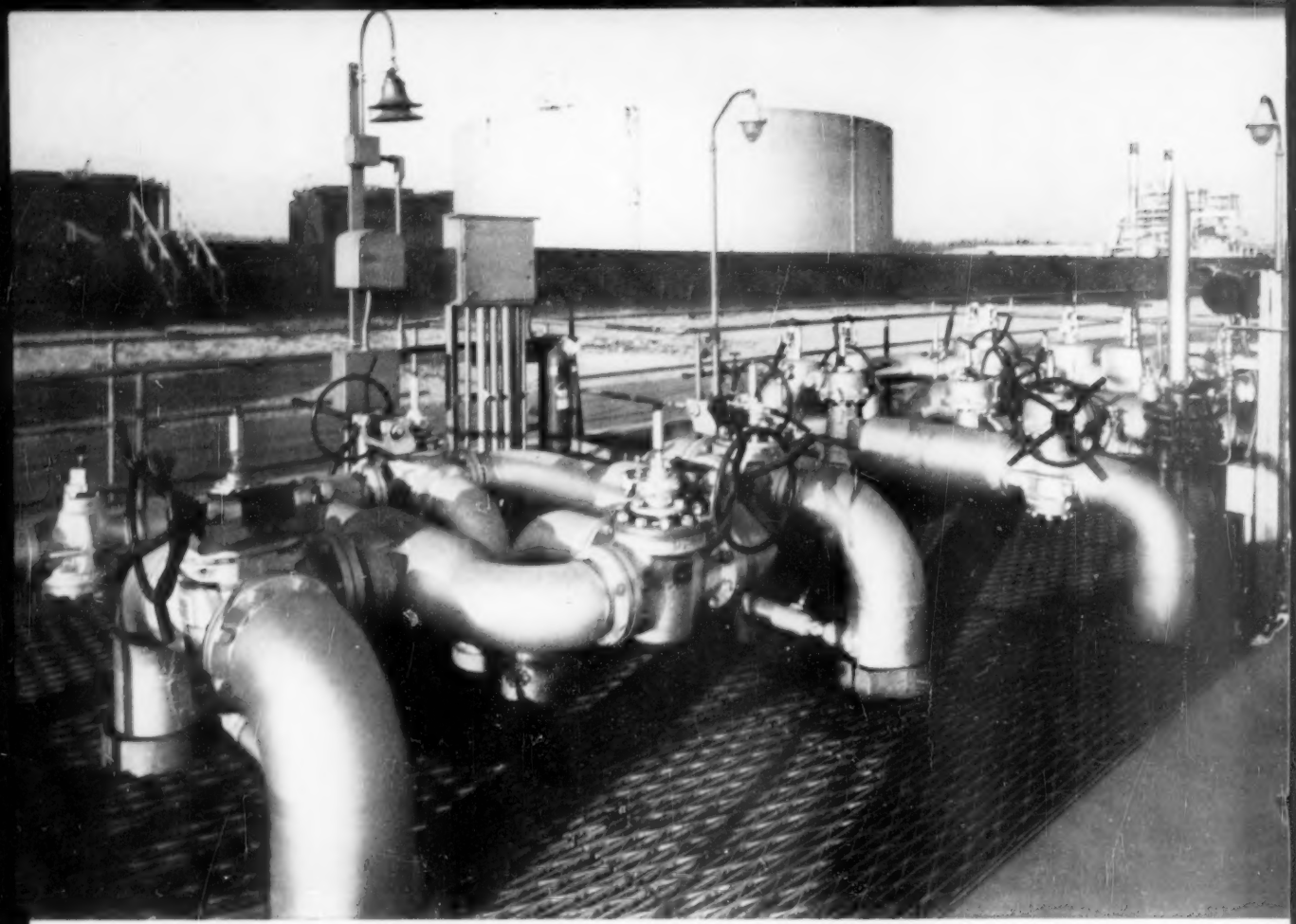

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with trouble free, economical **ROCKWELL**-Nordstrom **VALVES**

For *any* petroleum processing operation from tank farm manifolds like the one shown above to every processing-refining operation, Rockwell-Nordstrom valves assure safe, economical, dependable operation. The key to Rockwell-Nordstrom's forty years of leadership throughout the petroleum industry is *pressurized lubrication*. The unique Sealdport* system of grooves on the tapered plug and body carry pressurized lubricant that assures truly leakproof sealing and positive shut-off on lightest hydrocarbon gases or heavy crudes. Pressurized lubricant also hydraulically seats the plug for instant, quarter-turn operation. Because metal-to-metal friction is eliminated by lubrication, costly maintenance and down time are prevented.

Rockwell-Nordstrom, the *original* lubricated plug valve, is available in semi-steel, steel, stainless and corrosion resisting metals in sizes up to 30″ x 36″ for every petroleum processing requirement. For more data, contact any leading distributor or write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

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ROCKWELL-Nordstrom **VALVES**

Lubricant Sealed for Positive Shut-off

40th Year *of lubricated plug valve leadership*

A glance ahead . . . at press time

These trends will make TOMORROW'S NEWS

The first big switch to a dual-fuel diesel locomotive is not far off. A transcontinental railroad has ordered 50 such fuel systems. Using these, the locomotives would burn cheap residual fuel under medium and high-load engine operations, switching to a distillate fuel under low-load conditions.

Pembina will become the oil giant of Canada this month—ahead of most expectations.

Pembina has been given a production rate of 88,864 bbl. daily for February—2,064 bbl. more than Redwater, which has been Canada's biggest producer since its early development period. Leduc—a steady second since 1951—will drop to third. Alberta's total allowable for February has been set at 413,191 bbl. daily, a new record.

This year will bring a strong resurgence in alkylation construction. Early returns on the Journal's annual refining survey indicate new units to be started this year will boost total capacity by at least 25 per cent.

Some companies are doubling their production of this clean-burning high-octane gasoline component. Others are entering the field for the first time. The new projects are aimed at motor fuel—not avgas.

Coring from floating barges and portable drilling platforms off California will swing into high gear during the second half of '56.

Three barges already are at work. At least a half dozen more are being built or are planned. No oil wells will result, but the holes will yield valuable geological data for the future.

Mexico will soon be self-sufficient in oil. Pemex Director Bermudez says Mexico will quit importing gasoline in July. Oil men think the end will come sooner—in March or April. Pemex quit importing lube oil nearly a year ago. Gasoline—for the West Coast—is now Mexico's only oil import.

Petrofina will have a good-sized vehicle to ride into the United States if Panhandle Oil Corp. stockholders approve the plan for the Belgian company to buy in.

Petrofina will not only have effective stock control, but part of the deal is an increase of Panhandle's authorized stock to 10,000,000 shares. There are now 2,500,000, with only 1,592,970 outstanding. The additional stock would give Petrofina a virtually new company and the room in which to go almost anywhere from the Panhandle starting point.

Nominations for another sale of outer Continental Shelf leases will be received by the Bureau of Land Management this month.

Plans call for opening of bids this spring. The last sale brought in $100,000,000, and another sale would close to double the take. That would mean the oil industry will account for practically all of the $200,000,000 surplus the Treasury hopes to show for the current fiscal year.

the OIL AND GAS JOURNAL

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY—OPERATION

Refining—Processing

Hydrogen Treatment Improves Fuel Oils **85**
By R. P. Gilmartin, W. A. Horne, and B. R. Walsh
The new Gulf hydrogenation process upgrades the quality of distillates, improving their performance in heating equipment and internal-combustion engines.

Dow Reports Good Results from Styrofoam Insulation **95**
By Larry Resen
This multicellular plastic foam has been used for 5 years as insulation, with good results. No repairs are anticipated for some time to come.

British Petroleum Operates Complete Plant at Dunkirk **99**
This 41,000-bbl. refinery produces a complete range of petroleum products from Kuwait crude.

On-The-Job: In the Plants **102**
How Bel Oil has improved natural-gas dehydration—Portable scaffold simplifies tank painting—Built-in clamps hold instrument lines firm—other items.

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By Paul Reed
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Pipeline Patrol: Construction Tables **133**

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How Basic Electric-Log Curves Function **89**
By Robert V. West, Jr.
This series of logging articles explains present techniques and recent developments in electric logging in summary form.

Mist Extraction—An Art or a Science? **93**
By Dr. John M. Campbell
Mist extraction is one of the most important factors entering into the design of field processing equipment. This is the first in a series of several articles on designing for mist extraction.

Drilling Muds: Centrifuge Cuts Mud Costs **106**
By Ed McGhee
A drilling-mud centrifuge provided for a saving of $7,200 in the interval 9,200 to 13,000 ft. during the drilling of a South Louisiana well.

Drilling Muds: Walnut Shells Help Increase Drilling Efficiency **109**
By David A. Garrick
Walnut shells in drilling mud enable reduction of drill-pipe torque and drag. This material also reduces the amount of shale solids that tend to accumulate in drilling mud in some areas.

Drilling Muds: What Mud Particles Do to Your Pay **111**
By R. F. Kreuger and L. C. Vogel
Here are results of tests that show mud particles as well as mud filtrate invade the pores of permeable formations down hole. The particles may seriously reduce the permeability in a very short time.

Drilling Muds: How to Lick Deep Salt Problems in East Texas **114**
By Charles P. Lawhon and Jay P. Simpson
Deep salt drilling in East Texas has been hampered by a movement of salt into the hole as it is drilled. This requires careful control of the mud program and drilling procedure.

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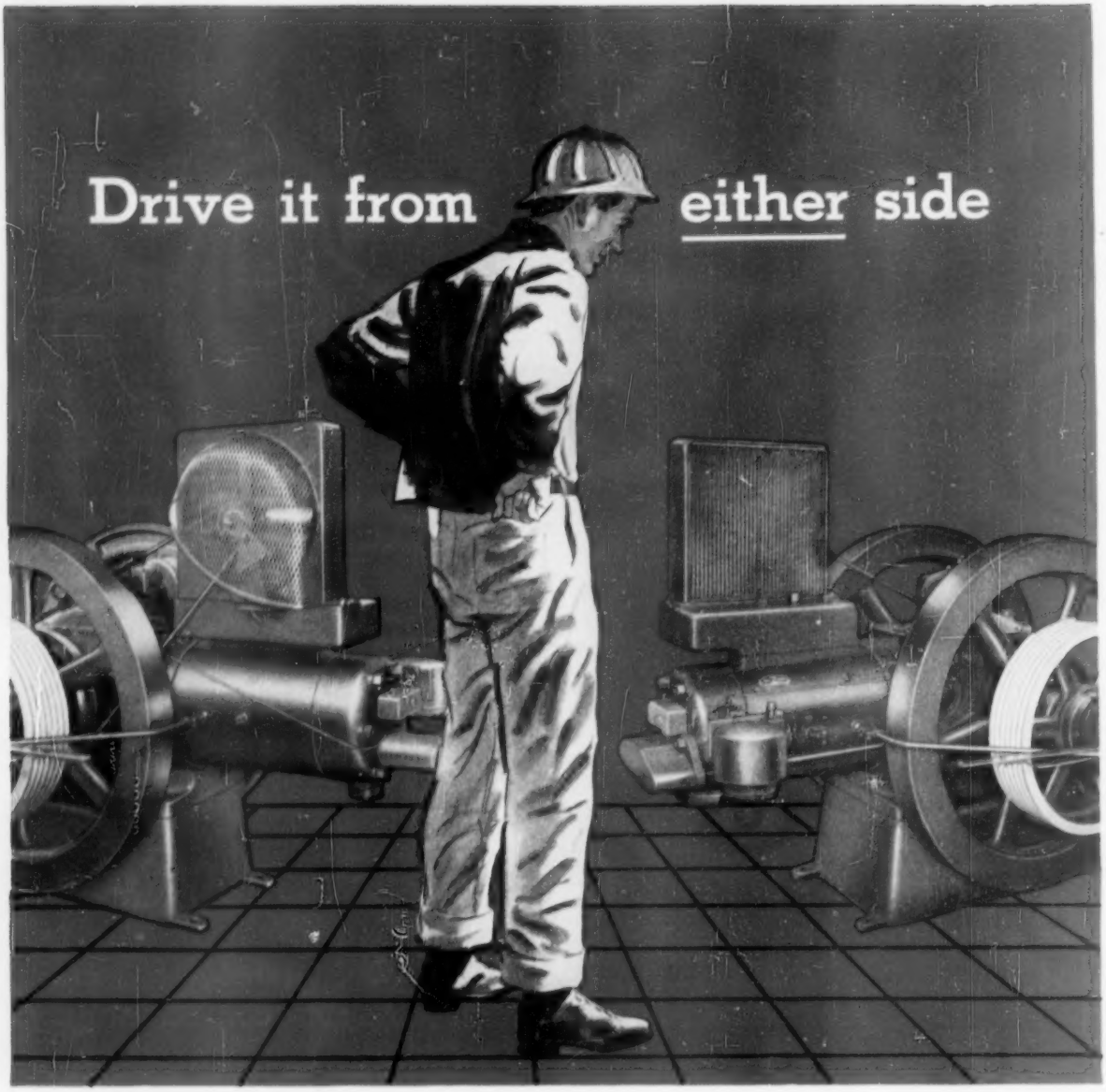

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"ZC"

You can mount a Fairbanks-Morse "ZC" engine on your pumping jack the way you want it. Clutch and sheave can be mounted on either side of the engine *without sacrifice in efficiency, smoothness or balance.* With the famous Fairbanks-Morse extra-heavy, large double flywheels, there is always one flywheel between engine and load. You get perfect balance, poised or rolling . . . smoother, more efficient, more economical operation.

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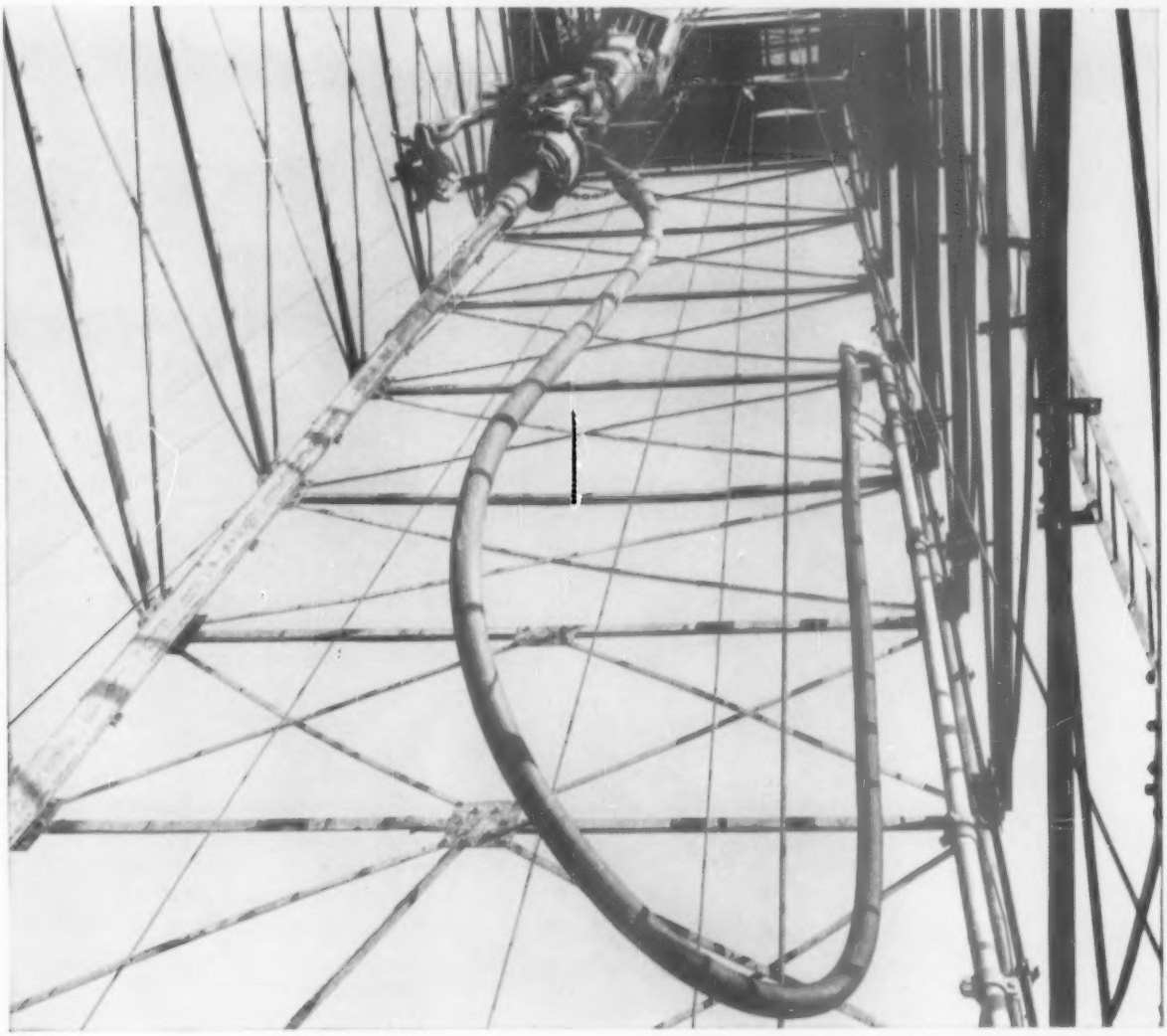
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Most flexible hose made for heavy-duty service

FOR all its toughness, B. F. Goodrich Highflex hose is the most flexible one made for heavy-duty service. It's easy to attach to the rig, hangs well from the standpipe, coils easily without kinking. And there's no dead weight to drag when Highflex is moved on or off the job.

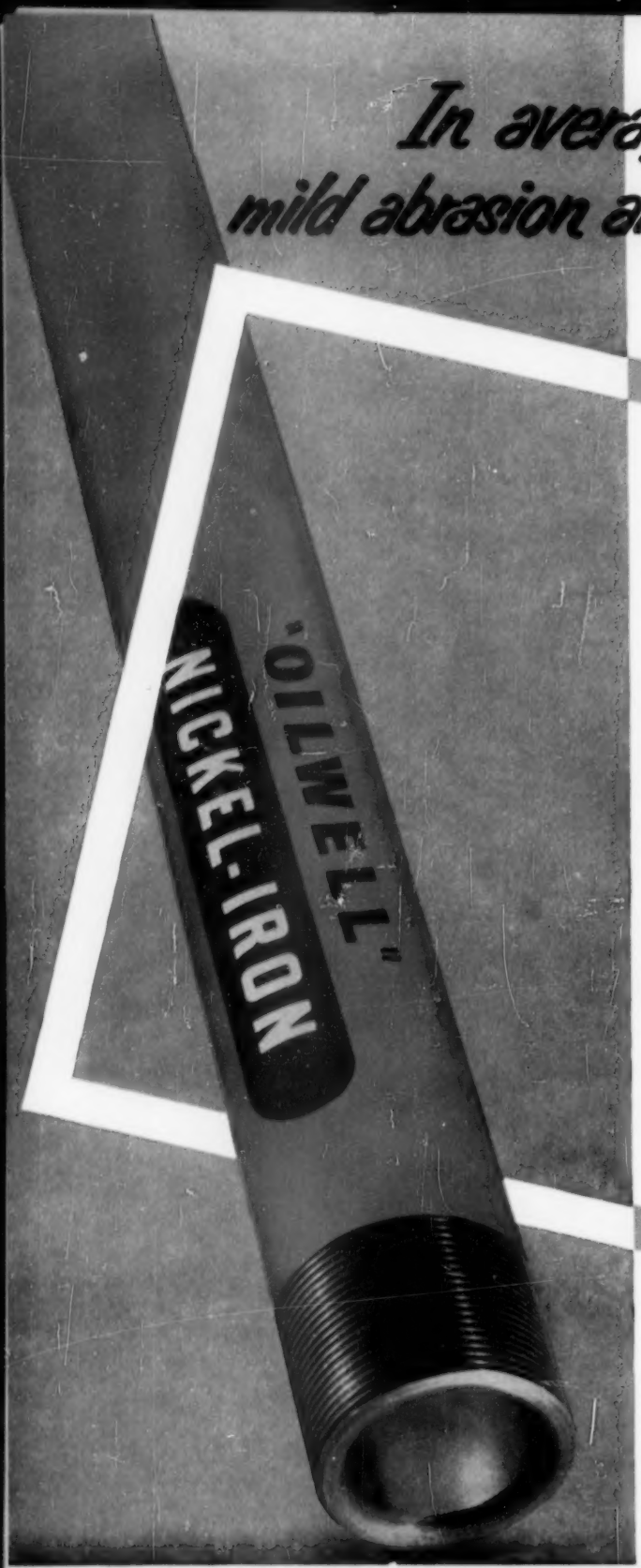
In addition to easier handling, this B. F. Goodrich hose has all the strength it takes to handle extreme bottom hole pressures. Spiral-wrapped cable wires make it resistant to bursts, qualify it for Grade C (5000 lb. test pressure) American Petroleum Institute. Extra layers of wire and fabric on the hose ends protect against bending stress. Extra strength here means extra safety for your crew and rig—no hose blowouts at the coupling.

The thick, tough cover on Highflex resists gouges, scrapes, tears. Sun, wind and rain will not harm it. Oily mud will not cause swelling or rotting of the tube

This longer-lasting hose is available at leading supply stores. And here's something to remember. When emergencies make service the *first* consideration in buying hose, you can get the replacement you need any time of day or night at one of these B. F. Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Hobbs, Oklahoma City, Tulsa, Dallas, Houston, Odessa, Wichita Falls. *The B. F. Goodrich Company, Dept. M-560, Akron 18, Ohio.*

B.F. Goodrich
INDUSTRIAL PRODUCTS DIVISION

In average wells with mild abrasion and medium corrosion



"Oilwell" NICKEL-IRON Subsurface Pumps give longer-than-average service

"Oilwell" NICKEL-IRON Pump Barrels are made from solid castings of fine-grained, nickel-alloy cast iron. Nickel strengthens and improves the inherent resistance of cast iron to corrosion, wear and impact.

By rifle boring these castings, a dense, tough, inside working surface is secured that can be honed and finished with extreme precision. Tolerances are so exact that factory matching of plunger components is unnecessary and out-of-stock, metal-to-metal plunger replacements fit perfectly.

NICKEL-IRON is available in both rod and tubing pumps, as well as working barrels for flexible plungers. Their low cost and their exceptional service records from Pennsylvania clear to the Rocky Mountains, prove them to be the most economical pumps you can buy for average well conditions.

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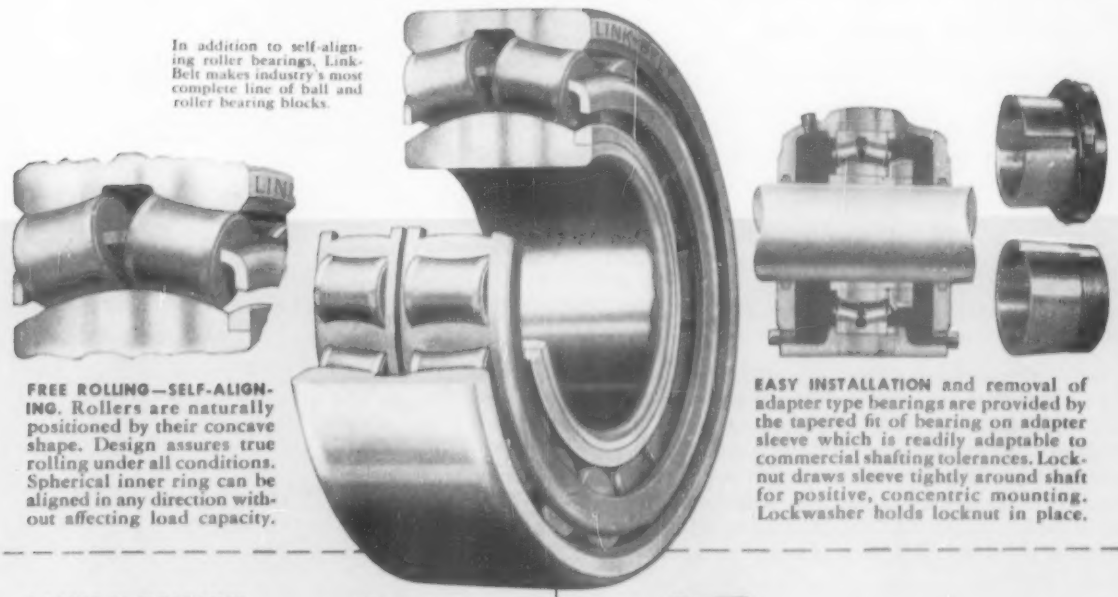
TRADE MARK

UNITED STATES STEEL

For tough, heavy-duty applications...make use of these important

bearing differences

In addition to self-aligning roller bearings, Link-Belt makes industry's most complete line of ball and roller bearing blocks.

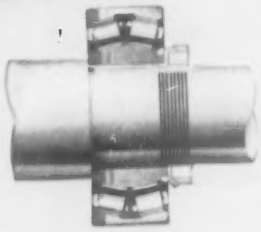


FREE ROLLING—SELF-ALIGNING. Rollers are naturally positioned by their concave shape. Design assures true rolling under all conditions. Spherical inner ring can be aligned in any direction without affecting load capacity.

EASY INSTALLATION and removal of adapter type bearings are provided by the tapered fit of bearing on adapter sleeve which is readily adaptable to commercial shafting tolerances. Locknut draws sleeve tightly around shaft for positive, concentric mounting. Lockwasher holds locknut in place.

LOCKED-IN CLEARANCE. Selective assembly of rollers and raceways with accurately formed hardened steel retainers assures proper operating clearance, guidance and spacing of rollers.

Rollers are completely pocketed in retainers for accurate spacing and guiding.



SMOOTH OPERATION, LONG LIFE are advantages of the straight bore type mounting, which assures maximum concentricity of inner ring with shaft. Especially desirable when minimum radial run-out is essential.

They're all present only in LINK-BELT self-aligning roller bearings

SUBTLE differences in bearings can make notable differences in the life and efficiency of your equipment. Take Link-Belt self-aligning roller bearings, for example. Their "self-contained" feature permits the bearing to float axially in the mounting, when desired, compensating for shaft expansion or settling of bearing supports . . . preventing extraneous thrust loads from being set up between bearings on the same shaft. What's more, inherent self-aligning design and preadjustment preclude use of expensive or cumbersome self-aligning housings.

Ask your nearest Link-Belt office or authorized stock-carrying distributor for Book 2196 on self-aligning roller bearings and Book 2550, containing full data on all Link-Belt ball and roller bearings.

LINK-BELT

Ball and Roller Bearings

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

Texas oil companies prove the value of split channel radio operation

G-E narrow band equipment serves Loffland Brothers, Standard of Texas, and Seaboard Oil Company

In the Texas oil fields they'll tell you that *practical* split channel radio operation is proving its worth right now. Two major oil companies and a major drilling contractor, operating in an area pointing north from Odessa to Vealmoor and Snyder, have cooperated in establishing three independently operated systems in a range that formerly served two firms.

Rather than share a channel when Loffland installed radio in the area covered by Standard's 48.74 MC frequency and Seaboard's 48.78 MC allocation, the three firms decided to work on an experimental split channel basis. Slight modification of G-E equipment in use narrowed the spacing from 40 KC to 20 KC, permitting Loffland Brothers' new General Electric radios to go on the air on 48.76 MC.

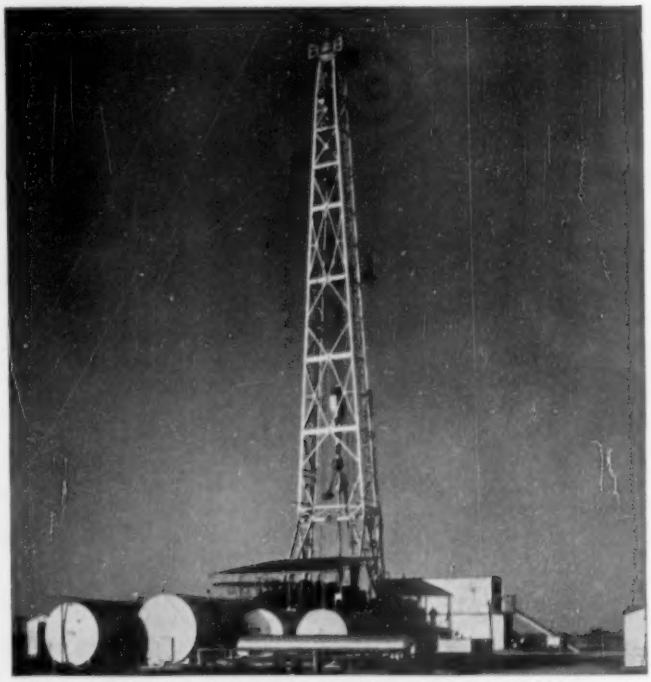
Clear channels for all

Now, each firm operates on its own frequency, without interference from either of the others. Because of split channel operation and General Electric narrow-band radio equipment, three companies benefit from 2-way radio communications without interference to one another.

The new G-E Progress Line of 2-way radio equipment provides a complete interchangeable package. Transmitter, receiver, power supply, and optional chassis are individually rack-mounted. Plug-in design permits quick changes of frequency, power, or type of reception.

2-WAY MOBILE RADIO

Your General Electric Communications Counselor will be pleased to cooperate with you in planning a split channel operation for your company. Call him in, or write today to: *Section X826-6, General Electric Company, Communication Equipment, Electronics Park, Syracuse, New York.*



RADIO ANTENNA CAPS LOFFLAND BROTHERS' RIG near Odessa, Texas. Nine General Electric base stations and mobile radio units have cut $400 per month from former telephone costs.

STANDARD OIL OF TEXAS operates two G-E 60-watt base stations linking seven mobile units with the main base at Snyder, Texas. Radio speeds orders, makes instant decisions possible for fast action.

SEABOARD OIL COMPANY maintains instant operational contact with field locations through 5 G-E base stations. 20 mobile units coordinate widespread drill site activities in the West Texas area.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Little Boomer—Oliver OC-3 and hydraulic side boom

OLIVER "Little Boomer" cuts pipelaying costs

Some operators use the Little Boomer to free bigger equipment for bigger jobs. Others substitute it for slow (and costly) hand labor.

Either way, the Little Boomer pays off.

Its capacity is surprising for a unit this size. Lifts 2000 pounds...carries 12-inch pipe in lengths up to 40 feet... lays and lowers pipe up to six inches in diameter. What's more, it's compact... easy to maneuver where larger rigs can't go...easy to transport on truck or trailer.

The OC-3 crawler with constant two-track power edges up to the ditch safely. Because the boom and line are both hydraulically controlled, it lowers pipe accurately and without jerking or jumping. Only two controls make operation simple.

Contact your Oliver Distributor. Ask about the low cost of your investment and the big returns you'll get from the Little Boomer—Oliver OC-3 and hydraulic side boom.

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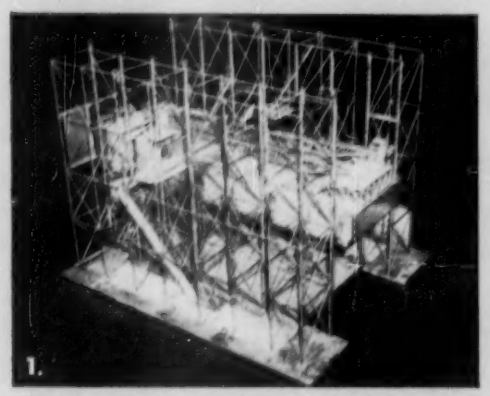
400 West Madison Street, Chicago 6, Illinois

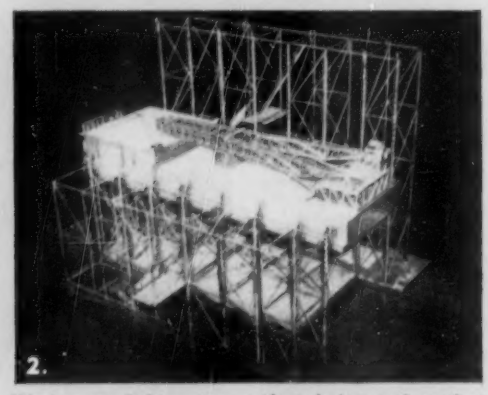
OLIVER

a complete line of industrial wheel and crawler tractors and matched allied equipment

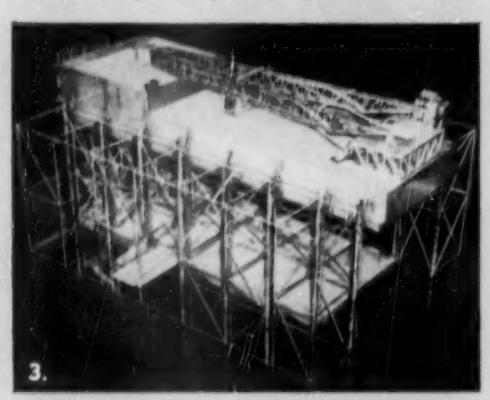
Higgins Deep-Water Platform* Interests Oilmen



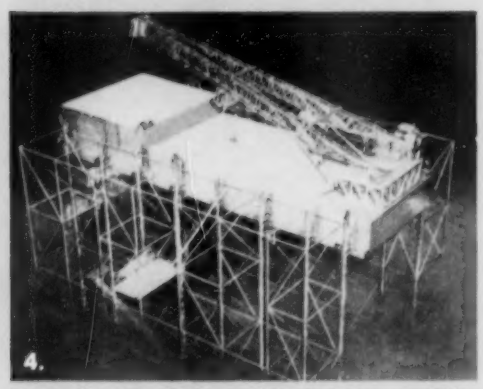
Operating model shows 3-section unit as towed to job in offshore field. Sections are secured by special devices which prevent parting, regardless of weather.



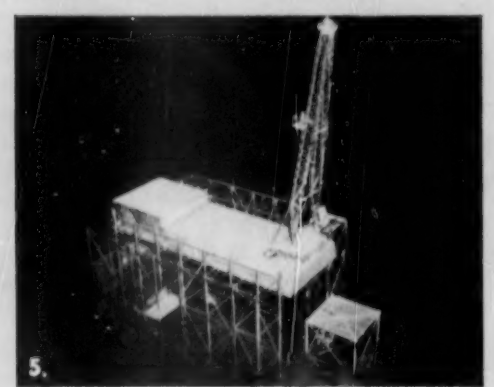
First, one of the outer sections is lowered so that pontoon rests on bottom of Gulf. Landing platform for service vessels is now in position.



Other outer section is next submerged. (Special wave-making device in model tank demonstrates how model withstands heavy gales.)



Center pontoon is lowered to bottom, providing broad base of support for drilling structure. Drilling platform and service decks, including helicopter landing deck, remain at top. Mast is raised.



With use of drilling mast as stiff-leg derrick the well-head protective jacket is set into drilling position. The new Higgins rig can be designed for depth up to 250 feet.

CHECK THESE ADVANTAGES

- Simplified construction reduces initial and maintenance costs.
- Ample clearance above mean gulf level permits operation under adverse conditions.
- Utmost stability, even during lowering and raising operations, makes for greater operating safety.
- Suitable spread footing offers sufficient resistance to movement from external forces.
- Large bearing area permits variation of bottom pressure to offset soil limitations in certain areas.
- Integrated units permit ease of transportation through locks, bridges and channels.
- Supply handling simplified to save time and thus further reduce operating costs.
- Makes possible the use of shallow-water drilling barges for deep-water operations.

* Patent Applied For

Q. Got a marine problem? **A. Get hold of Higgins INC.**

THE WORLD-FAMOUS BOAT BUILDERS
Box 8001 • New Orleans 22, La. • CRescent 0631

Get Higher Factor of Safety with New VHS Rotary Drilling Lines

• One of the many benefits drillers get with new VHS rotary drilling lines is higher factor of safety. For this new drilling line is 15% stronger than Improved Plow Steel—the strongest grade available before the introduction of VHS.

This means that 10 lines of VHS have a factor of safety 15% greater than 10 lines of the same diameter of IPS. Or, to put it another way, 10 lines of VHS have a factor of safety roughly equivalent to 12 lines of IPS.

TOUGHER, TOO!

New Lay-Set VHS is not only stronger, it's also tougher—and therefore it has higher resistance to peening, and greater resistance to abrasion. Both of these are important factors in maintaining shape and diameter. If regular adaptable cut-off practices are followed, ton-mile advantages should result.

CUT "DOWN TIME"

With new Lay-Set VHS you can drill deeper before increasing the number of parts of line. And VHS's extra strength eliminates, in many cases, any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

SIMPLE TO ORDER

You don't need any complicated specifications to order new Lay-Set VHS drilling lines. Just call your Hazard Distributor and tell him the length and diameter you want. He probably has it in stock—or he can get it readily.

for further information write to the nearest Hazard office for Brochure DH-522

LAY-SET VHS 15% Stronger • Tougher •

HAZARD WIRE ROPE DIVISION
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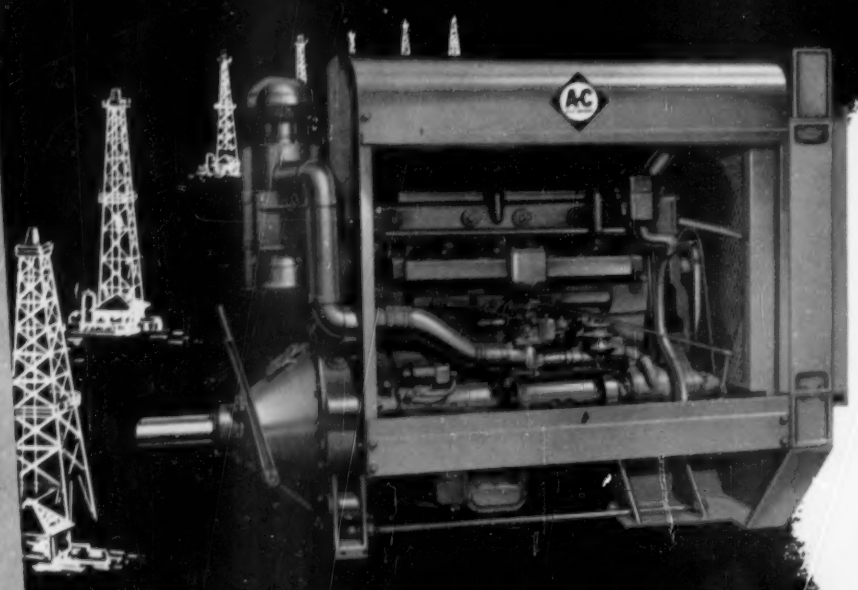
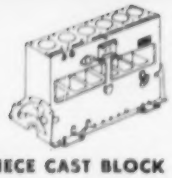
Wilkes-Barre, Pa.; Odessa, Texas; New York, N. Y.; Philadelphia, Pa.; San Francisco, Calif.



Here's why Allis-Chalmers OILFIELD ENGINES keep operating longer . . . at lower cost

Allis-Chalmers Oilfield Engines are big, rugged engines — built to deliver maximum performance under the toughest operating conditions. Every component in the diesel, natural gas and butane models is designed for longer life . . . greater efficiency or stamina to insure you more horsepower hours with less maintenance at lower all-round cost.

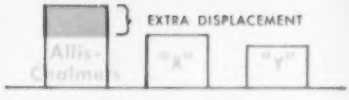


ONE-PIECE CAST BLOCK

Greater strength and rigidity of Monolithic block design insures longer engine, crankshaft and bearing life . . . less maintenance.

EXTRA STRONG, FORGED and TOCCO-HARDENED CRANKSHAFT

Larger diameter crankshaft, with thick, wide cheeks has the strength to withstand heavy loads, sudden shock. Smoother running is assured by precision dynamic balancing.



BIG PISTON DISPLACEMENT

Extra displacement means greater reserve power — lighter engine loading — less strain on the engine — more power in the normal operating range.

GREATER ROD BEARING AREA

Rod bearings are stronger . . . have more load carrying ability . . . longer service life. Connecting rods rifle drilled for pressure lubrication to wrist pins.

5 RING PISTONS

Increased contact area gives better compression seal, better oil control, longer ring and sleeve life — lower maintenance costs.

OVERSIZE PISTON PINS

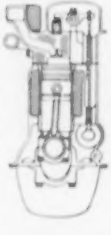
Larger overall bearing area gives greater strength and load carrying ability — longer life, less downtime and maintenance.

SUBMERGED-TYPE, FULL PRESSURE GEAR DRIVEN OIL PUMP

Lubrication system is positive displacement type — full pressure oil flow through drilled internal passages insures proper lubrication of all parts of the engine.

HIGH-VOLUME WATER PUMP, MAXIMUM FLOW COOLING SYSTEM

Large capacity, force feed water pump, full length water jackets, greater cooling area, full flow thermostat and by-pass system provide pinpoint temperature control, longer engine life.



See your nearby Buda Division Distributor for complete details on why Buda Division Oilfield Engines are your best buy in power. Write for Bulletin and specifications.

ALLIS-CHALMERS, BUDA DIVISION
MILWAUKEE 1, WISCONSIN

80—30

ALLIS-CHALMERS

NOW...30 HP!
NEW FUEL ECONOMY
FASTER STARTING
STALL-PROOF IDLING

NEW SEA-HORSE 30

NINE GREAT MOTORS

*JAVELIN	30 hp	$582.00
*SEA-HORSE 30	30 hp	552.00
SEA-HORSE 30	30 hp	462.00
*SEA-HORSE 15	15 hp	452.00
SEA-HORSE 15	15 hp	362.00
SEA-HORSE 10	10 hp	321.00
SEA-HORSE 7½	7½ hp	241.00
SEA-HORSE 5½	5½ hp	216.00
SEA-HORSE 3	3 hp	146.00

**Electric Starting... Prices f.o.b. factory, subject to change... OBC certified brake hp at 4000 rpm (30's at 4500 rpm).*

FOR 1956: Johnson presents NINE Sea-Horses . . . 3 to 30 hp! Featuring new fuel economy. Quicker, smoother starting than ever before. New Stall-Proof Idling. Electric and manual starting. Remote Control fittings for steering, shift, and throttle. *And traditional Johnson DEPENDABILITY.* All models are beautifully styled in Johnson's new Holiday Bronze and Spray White.

FREE! The new Sea-Horse Catalog gives the full story on all that's new for '56. New models, new features. New power and load-carrying ability. Write...

JOHNSON MOTORS, 6600 Pershing Road, Waukegan, Illinois

A DIVISION OF OUTBOARD, MARINE & MANUFACTURING COMPANY

In Canada: Manufactured by Johnson Motors, Peterborough

Johnson SEA-HORSES FOR DEPENDABILITY

ALL JOHNSON SEA-HORSES ARE PROTECTED AGAINST SALT WATER CORROSION — NO FLUSHING NECESSARY

***New* from INTERNATIONAL...**

New "go-anywhere" light-duty 4-wheel drive truck!

Here's the four-wheel-drive truck you've been waiting for! Here's a full-size, all-purpose truck you can use to go anywhere.

On or off the road, this new INTERNATIONAL S-120(4x4) will take the toughest grades in stride—fully loaded, it will move entire 7,000 lbs. of truck, body and cargo through soft sand, mud or snow. It's made to match all light-duty 4x4 jobs *exactly* with choice of 2 engines, 3 pickup and 2 stake bodies. Has exclusive INTERNATIONAL power take-off transfer case, plus optional power take-off transmissions for auxiliary equipment operation, is available in 6 tire sizes, including 7:00x18 for extra clearance and 9:00x16 for extra flotation and traction.

This newest INTERNATIONAL is all-truck built for rough, tough four-wheel-drive service . . . built to save you the BIG money, the operation and maintenance money. Before you buy any light-duty 4x4 truck, see and drive this one at your INTERNATIONAL Dealer or Branch!

INTERNATIONAL HARVESTER COMPANY • CHICAGO

A Complete Line of Light and Medium 4x4s for Every Tough Job Need

S-140(4x4). 11,000 lbs. GVW. Has 4-speed transmission and 2-speed transfer case, for 8 forward and 2 reverse speeds. 2 transmission power take-offs. Provision for third on transfer case.

S-160(4x4). 15,000 lbs. GVW. Has same transmission and transfer case as S-140 model, and like S-140 and S-120 has famous full-size Comfo-Vision cab and exclusive INTERNATIONAL features for easiest four-wheel-drive steering and handling.

INTERNATIONAL® TRUCKS

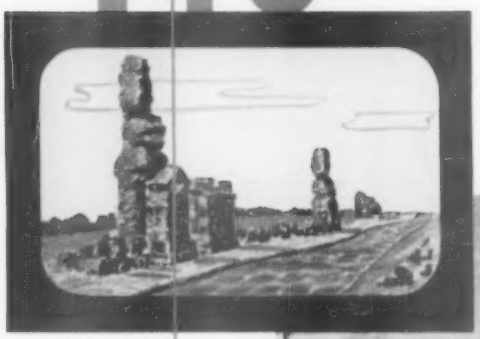
All-Truck Built to save you the BIG money!

Motor Trucks • Crawler Tractors • Industrial Power • McCormick® Farm Equipment and Farmall® Tractors

PROTECTS PRODUCTION IN DEEP HOT HOLES

POZMIX 140

new Halliburton cement, Pozmix 140, bestows the eternal durability of pozzolans



What goes down must get hot . . . and 'way down in a deep hot hole is where new, revolutionary Pozmix 140 sets the best.

This exclusive type of cement has a record for endurance dating back to the days of the Roman empire, when the Appian Way was built with pozzolans.

In Pozmix 140, made of the same basic pozzolanic material, you get a cement tailored especially for zones over 6000 feet, where the temperature is 140°F or higher. In those zones, where ordinary cements begin to lose stability and durability, and often gel up too fast, Pozmix 140 exceeds the API specifications for setting time by a wide margin. It retains uniformity, both physically and chemically. And it remains tough and hard, for protection of casing and formation . . . yet is easy to perforate with a minimum of shattering.

Among its other advantages over ordinary cements, Pozmix 140 is easily displaced at reduced pressures. Its spherical granules, like millions of tiny ball bearings, virtually enable it to "roll along" to point of application. Pozmix 140 also permits lighter weight slurries, and substantially reduces casing failures due to its better than average corrosion resistance properties.

And . . . it costs less than most cements which do not have these advantages!

So remember . . . when your bit reaches the hot zones . . . you can help correct deep-down cementing troubles by specifying Pozmix 140. Call your local or district office of the Halliburton Oil Well Cementing Company.

COMPLETE DATA SENT ON REQUEST

Get this valuable information for your Halliburton Service File.

HALLIBURTON CEMENTING SERVICES

250 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

1105...YES, ELEVEN-O-FIVE

is the new-strength wire in Roebling's

Royal Blue

WIRE 1105 ROPE

AS SIZES and constructions go, Royal Blue is like the ropes you have used until now... but the likeness ends there.

Royal Blue is made of Roebling's new 1105 wire, the strongest, toughest wire developed up to now for use in any wire rope.

Royal Blue Wire Rope is as enduring as the wire from which it is made.

Write us for full facts on Royal Blue Wire Rope, or contact your Roebling distributor.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

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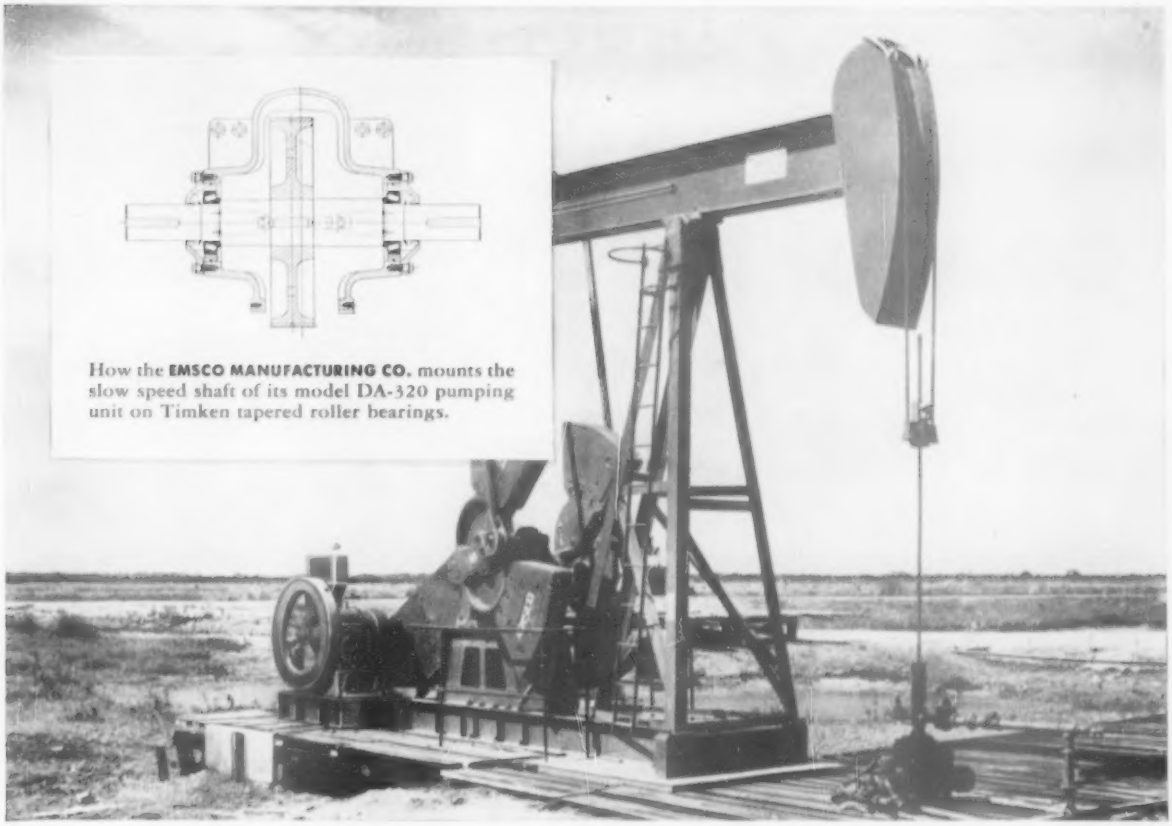


How the **EMSCO MANUFACTURING CO.** mounts the slow speed shaft of its model DA-320 pumping unit on Timken tapered roller bearings.

How TIMKEN® bearings hold shafts in alignment on all Emsco pumping units

EMSCO pumping units use herringbone gears. This means the bearings on the slow speed shaft must locate all the other shafts. And shaft alignment is important. These bearings must also take the radial loads from the slow speed gear and the overhung cranks.

Timken® tapered roller bearings handle all these jobs easily. They have full line contact between rollers and races, giving them a greater load-carrying capacity. And their tapered design lets them take *both* radial and thrust loads or any combination.

Result: end play and deflection are minimized; shafts are held in proper alignment; gear wear is reduced.

Timken bearings also hold housings and shafts concentric, making closures more effective. Lubricant stays in—dirt and moisture stay out. Lubrication costs are held to a minimum.

Emsco makes sure its customers get all these advantages. The slow speed shafts on its entire line of pumping units are on Timken bearings. You can get these same advantages by specifying Timken bearings on all the oil field equipment you build or buy. Just look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

This symbol on a product means its bearings are the best.

WE MAKE OUR OWN STEEL

The special grade alloy steel which gives Timken bearings their strength and resistance to wear is made in our own steel mills.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. Timken fine alloy steels.

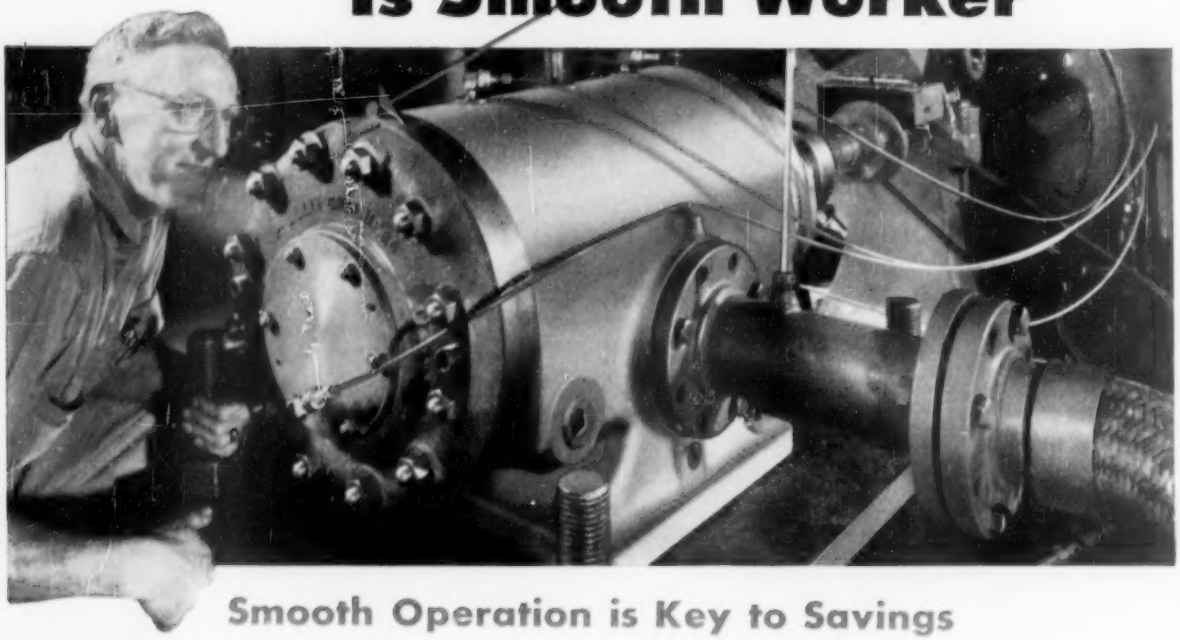
TIMKEN

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER — THE TIMKEN TAPERED ROLLER — BEARING TAKES RADIAL ◊ AND THRUST — LOADS OR ANY COMBINATION

Coin Trick Proves

RO-FLO COMPRESSOR Is Smooth Worker



Smooth Operation is Key to Savings

Everybody around the place knew the *Ro-Flo* compressor was a smooth operator. But just how smooth?

Someone suggested the old coin trick . . . balance a coin on it while it's running.

The next we knew the foreman was calling, "Come down and see for yourself." We went to the shop. And sure enough, there the penny was standing as still as you please.

What does that mean to you?

It means, here's a compressor that needs practically no foundation. And it means there's no wear and tear from vibration...less maintenance.

You get constant air supply with this machine, too. For this story: Call your nearby A-C office for complete information, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

A-4716

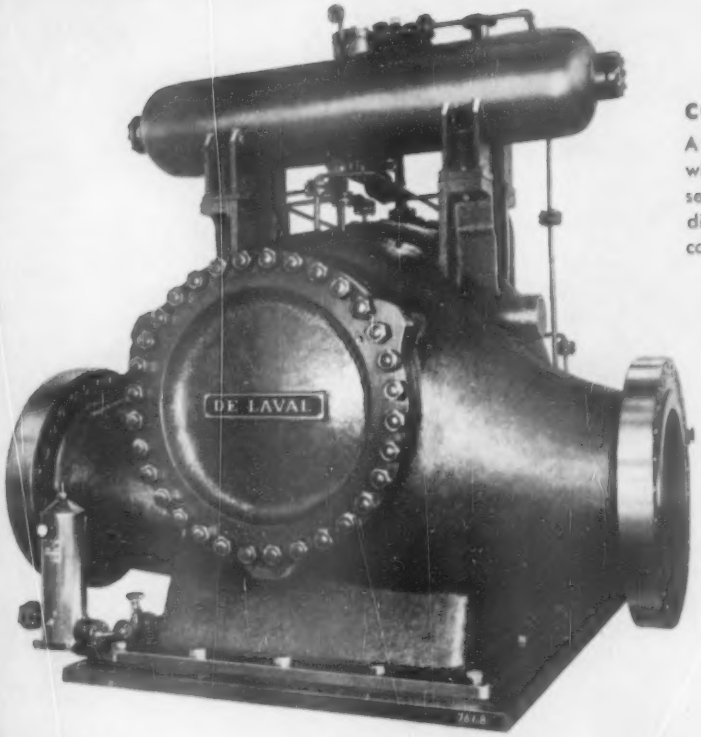
Ro-Flo is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Ro-Flo compressors provide constant efficiency and air supply for air tools

DE LAVAL
CENTRIFUGAL PIPELINE COMPRESSORS

come in two "packages" for easy installation

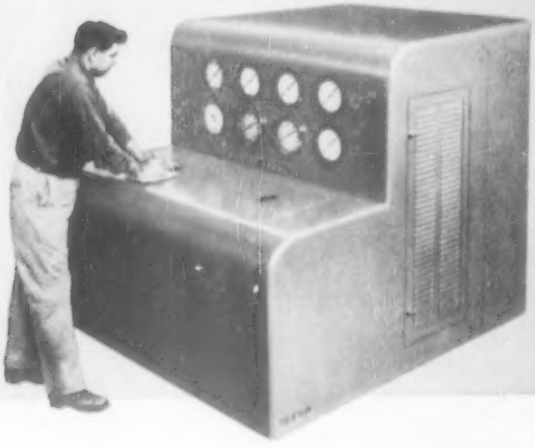


COMPRESSOR

A De Laval compressor with its emergency seal tank mounted directly on the compressor.

CONSOLE

The console contains the filters, motor-driven pumps, coolers, pressure switches, gauges and other accessories. It eliminates complicated piping on the packaged compressor . . . also serves as a protective cover for the equipment it houses.



Bulletin 503 gives data on De Laval centrifugal pipeline compressors. Write for your copy.

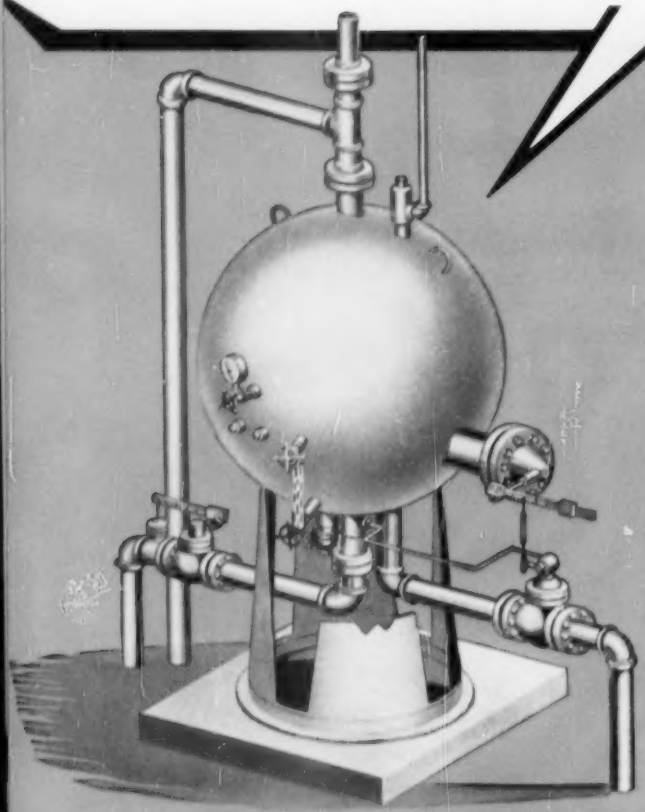
Designed in two packages, rugged De Laval centrifugal compressors offer many important engineering features. Among these are • high pressure contact shaft seal which eliminates gas leakage • heavy and rigid construction throughout • high load carrying capacity. The compressor and console arrangement makes De Laval centrifugal compressors easy to install—only simple low-cost foundations are required. De Laval units, totaling more than 280,000 horsepower, are now in operation on major pipelines.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY
810 Nottingham Way, Trenton 2, New Jersey

05-332

Introducing The New BS&B Oil-Gas Spherical Separator



It's The Model "OGS" With *Exclusive* Internal Design!

BS&B's exclusive new Spherical Separator design takes full advantage of the spherical characteristics of the separator to provide maximum separation efficiency.

The inlet stream enters the top of the separator and passes through *three* separating stages as it flows downward through the vessel. Liquid is collected in the lower hemispherical head and is discharged by a liquid level controller through an outlet in the bottom of the vessel. Gas is also discharged out the bottom of the separator through a separate gas outlet pipe.

Type 30-26 (Low Pressure)

WP: 125 and 230 psi.
Shell Diameters: 40", 41", 46", 54".

Type 30-27 (Intermediate Pressure)

WP: 600 psi.
Shell Diameters: 24", 36", 42".

Type 30-28 (High Pressure)

WP: 1200 and 2000 psi.
Shell Diameters: 24", 36", 42".

FEATURES

1. **Simple Hookup**
   Connections to top inlet and bottom outlets are easily made from any direction.
2. **Liquid Slugs**
   Internal design diverts liquid slugs rapidly to the liquid section.
3. **High Capacity**
   The large ratio of liquid surface area to volume in the liquid section allows rapid release of solution gas from the oil.
4. **Controls**
   All controls and valves are BS&B.
5. **Small Space Requirement**
   Compact design is a distinct advantage of the Model "OGS" over other separators.
6. **Servicing**
   Convenient access openings are provided to simplify periodic cleaning and blow-down.

For Full Details on the BS&B Model "OGS" Spherical Separator, Contact Your BS&B Representative, or Write to . . .

BLACK, SIVALLS & BRYSON, INC.
Oil & Gas Equipment Division, Dept. T-A2
1708 West Main Street • Oklahoma City, Oklahoma

EFFICIENCY · OVER 60 YEARS · BS&B · RELIABILITY · ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

February ★ One of a Series of Interest to the Petroleum Industry ★ 1956

Question Box

Want to get your TEL-handling people to think of safety "as a way of life"? Then you'll be interested in reading about the Du Pont Lead Hazard Clinic.

What makes a construction safety program, and what are the returns on a safety investment? To obtain a print of the movie that gives the answers, see the article on our film, "Builders of Tomorrow."

Who heads the Petroleum Chemicals Division Eastern Regional Lab? We'd like you to meet *Ed Jeffus*.

Have you heard about the oil industry's "best seller"? See the story about "Speak to the Earth."

THE DOLLARS AND CENTS OF SAFETY

New film of interest to refinery construction personnel

"The Builders of Tomorrow" is the title of a film about accidents that never happened. More importantly, it illustrates how and why they never happened.

This 28-minute color movie was made on location as the Du Pont Engineering and Construction Division erected the A.E.C.'s Savannah River Atomic Energy Plant in Aiken, S. C.

This plant, a 4½-year task, involves massive equipment, thousands of workers and many different hazards. It is one of the largest and safest construction undertakings in history.

In one period of over 6,000,000 work hours, not a single disabling injury occurred. The safety record achieved at Savannah River was 36 times better than the national average for this type of work.

Of interest to refiners

Many safety problems, similar to those encountered in the oil industry, were solved on this project. "The Builders of Tomorrow" should prove stimulating to engineers, supervisors and others concerned with construction safety. For this reason, the Du Pont Petroleum Chemicals Division has obtained prints of the film. Any sales office will be glad to arrange showings.

Du Pont Lead Hazard Clinic helps promote safe TEL handling through education

Because the dangers inherent in the use of tetraethyl lead are of a serious nature, the Du Pont Company, as supplier of this compound, offers refiners a program to help maintain safe handling operations. Originated in 1951, the program is called the Du Pont Lead Hazard Clinic. A review in January, 1956, showed that Du Pont had presented the clinic 280 times for 44 oil companies before a total audience of 7,787 persons.

Refinery personnel whose work brings them into proximity with TEL learn about the Du Pont Lead-in-Air Analyzer. Slides and booklets help make the Du Pont Lead Hazard Clinic easy to understand.

The clinic is available to all refiners. It is suitable as a refresher course for refinery, marketing, pipeline and terminal supervisory personnel and as a supplement to your own training courses.

Your problems discussed

The six sections of the clinic program cover the toxic properties of TEL, the source of TEL tank cleaning and repair hazards, safe cleaning practices, demonstration of the Du Pont Petroleum Chemicals Division Lead-in-Air Analyzer, a question and answer period, and a summation.

A way of life

Called "Something Else Is Necessary," the summation is delivered by the Petroleum Chemicals Division Medical Director. It emphasizes to the individual his own responsibility in

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED **Hazard Clinic**

achieving safe TEL handling . . . in making safety "a way of life."

Experience has shown that the question and answer period offers one especially important benefit to your employees. It gives them a chance to get detailed answers to particular problems from men with extensive experience in every facet of TEL handling.

Visual aids

In easy-to-remember form, a slide presentation shows graphically the safe procedures and recommended precautions for tank entry work. This part of the clinic program is followed by a 5-minute demonstration of the Du Pont Lead-in-Air Analyzer.

A booklet, "Tank Talk," recaps the clinic and a copy is given to each member of the audience. Over 20,000 copies have been distributed and the booklet is now in its third printing.

Available to all

In the interest of sound preventive medicine and good industrial safety practice, Du Pont makes this clinic available to all oil companies. It is recommended for supervisory personnel currently concerned with TEL handling procedures, and to others who may in the future be assigned to this area of operation. To keep their programs up to date, some refiners have set up repeat clinics on an every-other-year basis.

If you would like further information about the Du Pont Lead Hazard Clinic, consult your local Du Pont Petroleum Chemicals Division representative.

HEADS PETROLEUM CHEMICALS DIVISION EASTERN REGIONAL LAB

Ed Jeffus joined the Du Pont Petroleum Chemicals Division in 1950 and was appointed Eastern Regional Laboratory Manager in January 1952. As manager, he works closely with refiners and provides technical services which are directed toward the more efficient utilization of petroleum additives.

Prior to joining Du Pont, Jeffus was a chemist at the Shell Oil Company's refinery at Norco, Louisiana.

His entry into the petroleum industry followed schooling at Magnolia A. & M., Magnolia, Arkansas, M. I. T., and ending with a B. S. in chemistry at the University of Arkansas in 1948. During World War II, he was a meteorologist in the U. S. A. F. and served a 25-month overseas tour in England and France.

Originally from Texarkana, Arkansas, Ed now lives in Wilmington, Delaware with his wife and two children. His hobbies include hunting, fishing, skeet and bridge.

EDISON D. JEFFUS

Mr. Jeffus is a member of the American Chemical Society.

"Speak to the Earth" in Third Edition

Appleton-Century-Crofts, Inc., publishers, have announced a new printing for "Speak to the Earth," a book about the oil industry. The writing of this book was commissioned by the Du Pont Company.

The initial printing was a de luxe edition which was exclusively distributed by the Du Pont Petroleum Chemicals Division. At the same time, a standard edition was produced and marketed to the public by the publisher. This has been sold out.

Of the edition now in printing, 1500 copies will be used by the O.I.I.C. The remainder will be available through regular book stores.

Written by Max Miller, "Speak to the Earth," was first introduced in June, 1955.

DU PONT
Better Things for Better Living
. . . through Chemistry
Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

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ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-751

Printed in U. S. A.

AXELSON PUMP REPAIR SHOPS

"Good as new" no idle phrase!

Any well on the pump is a more satisfactory producer when Axelson equipped. There are two reasons.

First, no misfits. We furnish an Axelson pump tailored to fit your well. It can be completely of stainless steel if needed.

Second, we keep your pump in the pink of condition. "As good as new"

Through repair shops like this one in Hobbs, New Mexico, J&L has completely abolished the age of retirement for Axelson pumps. Here is truly advanced therapy. No hospital boasts more highly specialized equipment, or such a wonderful assortment of "spare parts."

can mean an Axelson that has been in service for years. *Never* junk an Axelson.

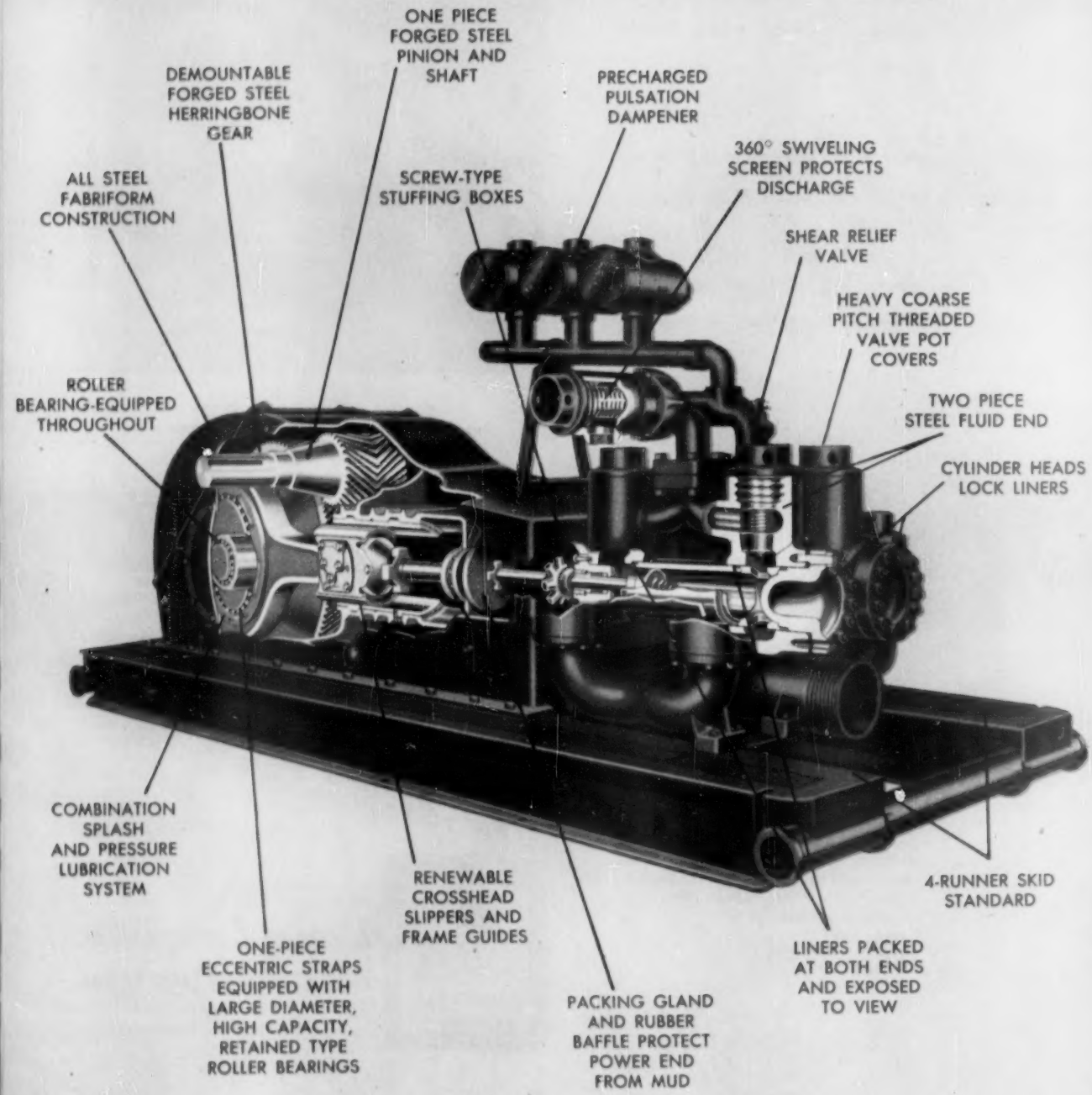
The right Axelson pump plus J&L stand-by service add up to the utmost economy and satisfaction in producing a well.

Ask any J&L man about the Axelson pumps that are doing such a good job in your field.

J&L STEEL

Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION —— TULSA
Serving The United States and Canada

LET'S TAKE A LOOK AT THE INSIDES OF THE POWERFUL, PORTABLE, LIGHTWEIGHT....


ONE PIECE FORGED STEEL PINION AND SHAFT
DEMOUNTABLE FORGED STEEL HERRINGBONE GEAR
PRECHARGED PULSATION DAMPENER
360° SWIVELING SCREEN PROTECTS DISCHARGE
ALL STEEL FABRIFORM CONSTRUCTION
SCREW-TYPE STUFFING BOXES
SHEAR RELIEF VALVE
HEAVY COARSE PITCH THREADED VALVE POT COVERS
ROLLER BEARING-EQUIPPED THROUGHOUT
TWO PIECE STEEL FLUID END
CYLINDER HEADS LOCK LINERS
COMBINATION SPLASH AND PRESSURE LUBRICATION SYSTEM
RENEWABLE CROSSHEAD SLIPPERS AND FRAME GUIDES
4-RUNNER SKID STANDARD
ONE-PIECE ECCENTRIC STRAPS EQUIPPED WITH LARGE DIAMETER, HIGH CAPACITY, RETAINED TYPE ROLLER BEARINGS
PACKING GLAND AND RUBBER BAFFLE PROTECT POWER END FROM MUD
LINERS PACKED AT BOTH ENDS AND EXPOSED TO VIEW

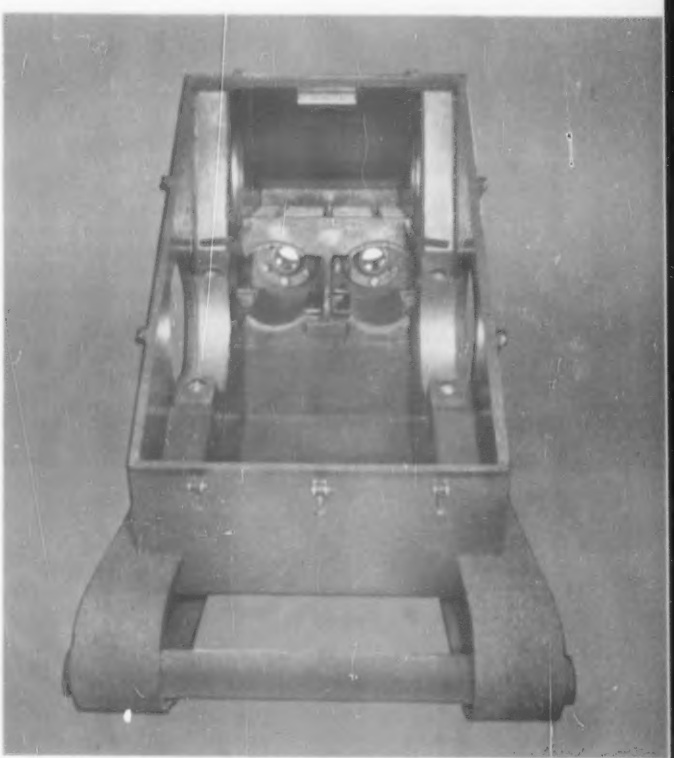
EMSCO SLUSH PUMPS

Learn how Sound Engineering and Advanced Techniques of Fabrication, Metallurgy and Precision Machining combine Powerful Performance with Lightweight Construction

See for yourself the many exclusive built-in features!

No matter what your mud circulating requirements are, you will find an EMSCO Slush Pump to meet your needs. There are six models, D-175, D-300, DA-500, D-700, D-850, and D-1000, for shallow, medium and deep drilling, for jet bit or big hole. Each model is a masterpiece of advanced design and skilled workmanship and is built for heavy duty performance under tough conditions, yet is lightweight and offers maximum portability.

Call your nearest EMSCO representative today and learn more about EMSCO Slush Pumps.



Note "Fabriform" construction of power end frame.

EMSCO

REG. U.S. PAT. OFF.

EMSCO MANUFACTURING COMPANY

Houston, Texas • LOS ANGELES, CALIF. • Garland, Texas

General Sales Offices: Dallas, Texas

Distributors: Bovaird Supply Company, Tulsa, Oklahoma
Mid-Continent Supply Company, Fort Worth, Texas
Export distributor: Mid-Continent Supply Company, Inc., 45 Rockefeller Plaza, New York 20, N.Y.

SP-601

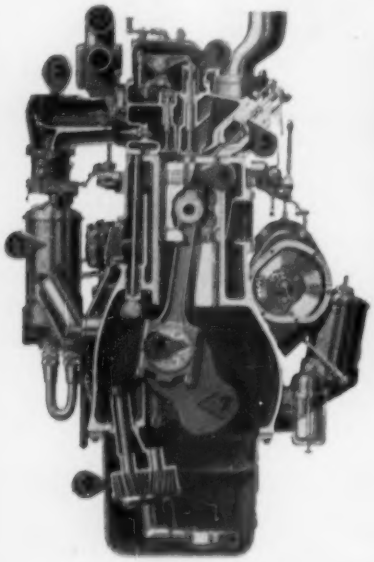
1 FULL FLOW OIL FILTER—Before oil goes under pressure to engine bearings, all harmful particles are removed by replaceable plastic-impregnated, full-flow filters.

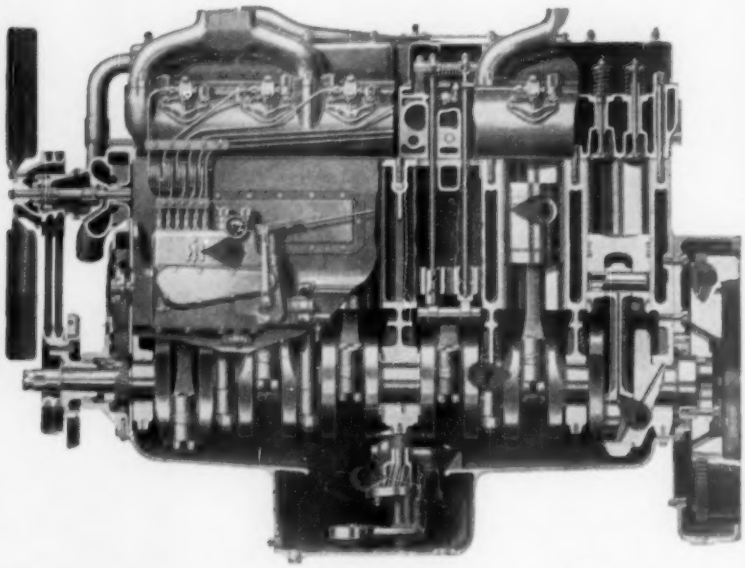
2 POSITIVE ROTATORS EXTEND VALVE LIFE. Exhaust valve rotators keep valves turning, at all engine speeds, distributing heat uniformly around the valves to keep deposits from building up on stems and seats, and also to prevent sticking, scuffing, and burning.

3 POSITIVE ALL-WEATHER STARTING. Seconds-fast, International Diesels start in coldest weather on exclusive gasoline starting system. Cylinders are pre-heat conditioned to give complete, clean combustion, instantly, on switching to operation on Diesel fuel.

4 ALUMINUM-ALLOY PISTONS have a thick crown at the top for rapid dissipation of excess heat direct to the cooling water. Hardened, replaceable, cylinder sleeves, three compression rings, with top ring chrome-plated, plus two oil control rings assure long-lasting, gas-tight seal for high compression ratios of over 15 to 1 . . . providing top fuel and oil economy.

5 SIMPLE, SINGLE-HOLE, INJECTION NOZZLE and pre-combustion chamber set at 45° angle for smooth, clean combustion of low grade No. 2 fuel oil under all engine speed and load conditions.





6 NEW IH INJECTION PUMP: Single plunger type on four-cylinder models, twin-plungers on six-cylinders . . . provide all cylinders equal amounts of fuel, precisely metered to load, whether for idling, maximum horsepower, or maximum torque under overload. New, harder injection plungers have up to four times longer life.

7 HEAVY-DUTY FORGED CRANKSHAFT with large diameter, induction-hardened journals provides long-lasting, wear-resistant bearing surfaces . . . rifle-drilled for full pressure lubrication . . . dynamically balanced for smooth operation.

8 REPLACEABLE TRI-METAL BEARINGS provide precision clearance for full-pressure lubrication and thousands of hours of heavy-duty work. Smooth electroplating of white alloy metal over copper-lead, precision bonded to a steel back, carries heavy loads with minimum friction.

9 FULL-PRESSURE LUBRICATION for long life. Big, gear-type pump delivers oil under controlled pressure through full-flow filters and rifle-drilled passages to main and connecting rod bearings, piston pins, camshaft, timing gears, and valve rocker arms.

10 HEAVY FLYWHEEL helps to maintain uniform speed under widely varying load conditions. Available to match standard makes of clutches, fluid couplings, and torque converters.

Hour after hour. . year after year

INTERNATIONAL ENGINES

. . . stay on the job with least upkeep

All International engines are built throughout to give you a full measure of power that stands up and stays on the job. They are precision-manufactured of thoroughly tested materials under continuous, quality-control inspection. Pressure lubrication through rifle-drilled crankshafts and internal passages assures trouble free performance. Inbuilt precision is fully protected from dirt and grit under the worst of job operating conditions by the best of fuel, oil, and air filters.

Heavy-duty radiators, power take-offs, and other factory-engineered power unit components are available to fit these long-life, money-saving engines to your job requirements. You can also get them as original equipment in most makes of construction machines. Call your nearest International Industrial Power Distributor or Power Unit Dealer for all the facts.

There's a size and type of International engine to fit your needs . . . from 16½ to over 200 hp.

INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

Moisture-resistant. K&M Apac sheets are used on the ceiling of this tall entrance and custom office inspection enclosure at the Port Huron, Michigan, Blue Water International Bridge. The moisture in the air at the bridge won't harm them.

You'll be wise to choose

K&M APAC

Asbestos-Cement Sheets

• •

Interiors—Exteriors

Remarkable economy!

Temperature, humidity safeguards. Walls of K&M Apac sheets give dependable aid to a cigar manufacturer in an important process—where temperature and humidity are accurately controlled.

All-purpose sheets. This photo shows K&M Apac sheets being applied on a building where they are used for both outside and inside walls as well as for ceilings.

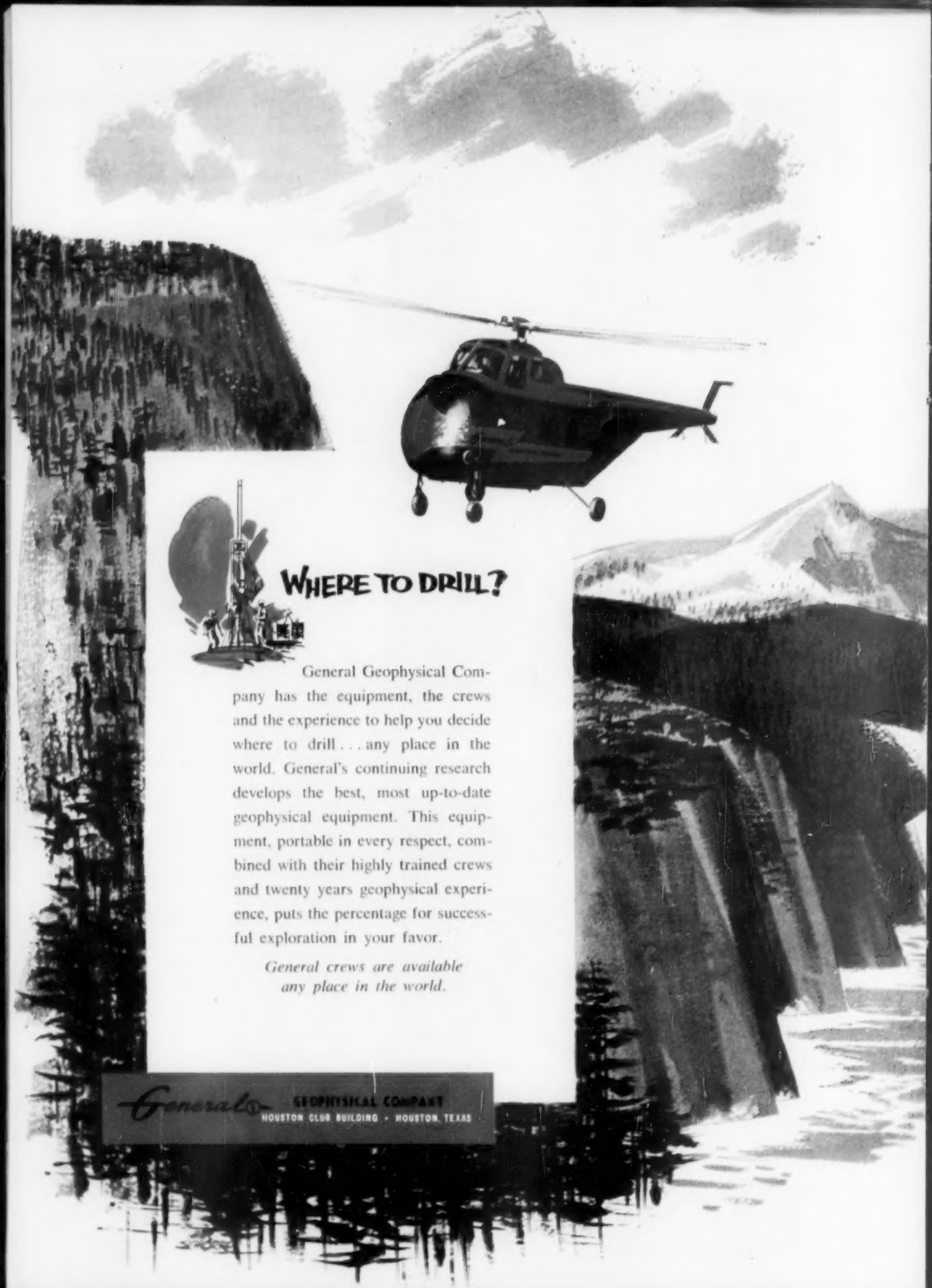
You'll find a thousand and one uses for these flat asbestos-cement sheets: as an interior and exterior siding, office paneling, plant and office ceilings, machine shop sheathing, stock room sidewalls, basement partitions, linings for elevator casings. Use them almost everywhere, inside and outside.

Built to last. K&M Apac sheets are made of two practically indestructible materials, asbestos fiber and portland cement. They won't burn, rot, or corrode. And they never need protective paint.

Look over the illustrations. See a few of the many places where Apac sheets are applied. Then contact your K&M distributor, and ask him to tell you more about low-cost K&M Apac sheets. Informative folders also available on request. Address inquiries to our headquarters in Ambler, Pa.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®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General Geophysical Company has the equipment, the crews and the experience to help you decide where to drill . . . any place in the world. General's continuing research develops the best, most up-to-date geophysical equipment. This equipment, portable in every respect, combined with their highly trained crews and twenty years geophysical experience, puts the percentage for successful exploration in your favor.
General crews are available any place in the world.
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. . . who support the SERVICE TEAM

The TEIA Salesman-Serviceman, the Underwriter, the Safety Engineer, the Claim Man, the Payroll Auditor . . . these are the members of the TEIA SERVICE TEAM directly providing you with the best possible Workmen's Compensation Insurance SERVICE.

But, supporting this SERVICE TEAM are hundreds of Home Office and District Office workers . . . the important "behind-the-scenes" people who are trained to render specialized Workmen's Compensation services. They, too, are constantly striving to provide you with better service and help you SAVE money.

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Saved and Returned to
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TEXAS EMPLOYERS INSURANCE ASSOCIATION
HOME OFFICE - DALLAS, TEXAS

Enough to run a pipe line from San Francisco to London

THE gas and petroleum transmission industries can take great pride in the gigantic jobs they've completed in recent years.

As a major supplier of large diameter steel line pipe, Kaiser Steel has been privileged to play an important part in these vast undertakings. In five years, enough line pipe of various diameters has been shipped from our Napa, California plant to run a pipe line from San Francisco to London.

Shown below is a partial list of major customers, who have used Kaiser Steel Line Pipe in scattered locations from New York to California, from Canada to Mexico.

CITIES SERVICE GAS CO.
NORTHERN NATURAL GAS COMPANY
PANHANDLE EASTERN PIPE LINE CO.
SINCLAIR PIPE LINE CO.
INTERPROVINCIAL PIPE LINE CO.
OKLAHOMA NATURAL GAS CO.
PLATTE PIPE LINE CO.
NATURAL GAS PRODUCERS, INC.
THE MONTANA POWER COMPANY
COLORADO INTERSTATE GAS CO.
ARAPAHOE PIPE LINE CO.
TRANS MOUNTAIN OIL PIPE LINE CO.
MOUNTAIN FUEL SUPPLY CO.
SOUTHERN UNION GAS CO.
EL PASO NATURAL GAS CO.
PACIFIC GAS & ELECTRIC CO.
STANDARD OIL COMPANY OF CALIFORNIA
UNION OIL COMPANY OF CALIFORNIA
RICHFIELD OIL CORPORATION
SOUTHERN COUNTIES GAS CO.
TIDE WATER ASSOCIATED OIL COMPANY
SOUTHERN CALIFORNIA GAS COMPANY

Kaiser Steel

GULF OIL CORPORATION
GULF REFINING COMPANY
PHILLIPS PETROLEUM CO.
PHILLIPS PIPE LINE CO.
TENNESSEE GAS TRANSMISSION CO.
THE TEXAS PIPE LINE COMPANY
PIONEER NATURAL GAS COMPANY
TRUNKLINE GAS COMPANY
TRANSCONTINENTAL GAS PIPE LINE CORP.
TEXAS EASTERN TRANSMISSION CORP.
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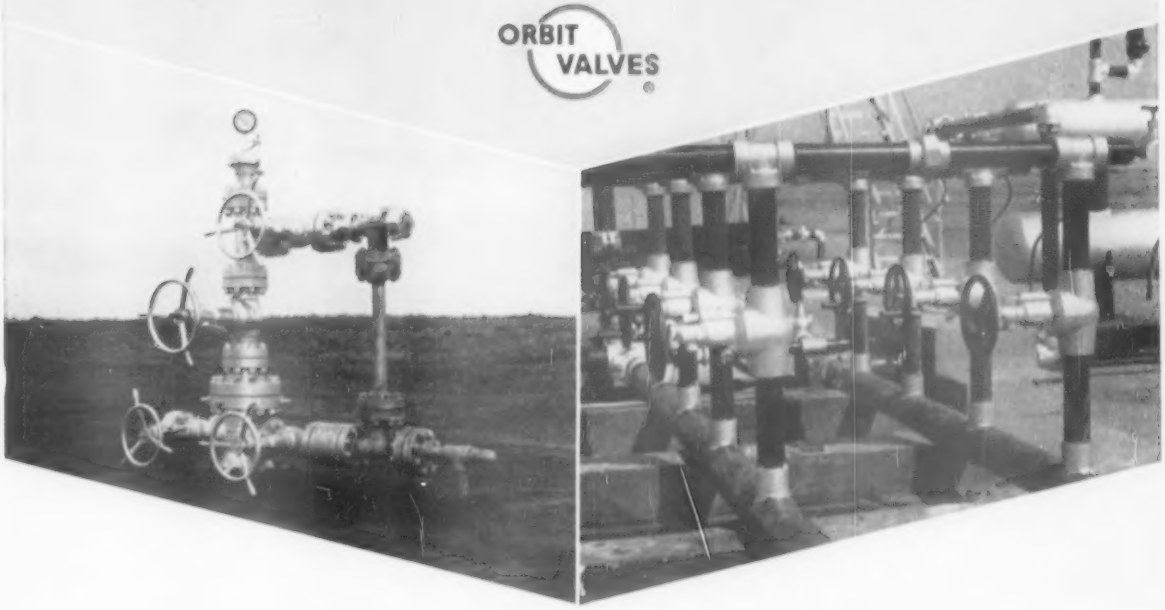
Steel Mill Products: plates • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • bar shapes • structural shapes • semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe • reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**

Safe from Well to Storage

ORBIT VALVES



POSITIVE SEATING
Orbit Production Valves

Positive closure in Orbit Valves is insured because there is no distortion of metal to obtain closure; Orbit's yielding body seat always resists further compression of the seating segment by pushing back against it.

Friction between the body seat and the face of the core has been eliminated because of the free movement of these parts. Contact of the major seating surfaces is obtained by the "rolling" action of the seating core into the body seat.

Orbit's streamlined design permits reduced weight and allows installation in minimum space. For longer periods of uninterrupted service use ORBIT valves —they give longer continuous heavy duty service.

A full range of sizes are available beginning with 1", to and including 4". Test pressures 1,000 to 10,000 lbs. API Class. Screw and Flange end.

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CASPER, WYOMING
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you can meet your needs

exactly

Ethylene Glycols

Ethanolamines

For Gas Purification—Mono- and diethanolamine of uniform purity for H_2S and CO_2 scrubbing. Mathieson production consistently meets standard specifications.

For Gas Dehydration—Di- and triethylene glycol with the most important specification: "convenient availability." Stocks of Mathieson products are located to give prompt service in all important refining areas.

For Selective Extraction—Diethylene glycol with highest purity specifications is the answer. Olin Mathieson can supply to meet your most exacting requirements.

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Ask us to meet your particular need exactly. Write or call.

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INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

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INORGANIC CHEMICALS: Ammonia • Bicarbonate of Soda • Carbon Dioxide • Caustic Soda • Chlorine • Caustic Potash • Hydrazine and Derivatives Hypochlorite Products • Nitrate of Soda • Nitric Acid • Soda Ash • Sodium Chlorite Products • Sulphate of Alumina • Sulphur (Processed) • Sulphuric Acid

ORGANIC CHEMICALS: Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether Formaldehyde • Methanol • Sodium Methylate • Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol • Trichlorobenzene

LEE Corporation

RENTAL CRANES and Equipment

Lee Corporation's crane rental and construction equipment service is available for lease — ANYWHERE. Lee rental equipment saves you capital investment and relieves you of the worry and expense of repairs and maintenance. Heavy duty equipment, including cranes with 50- to 100-ton capacities, is available anywhere in the world. All equipment carries like-new guarantee.

Lease from Lee on your next job, and let Lee prove to you how this equipment actually saves you money.

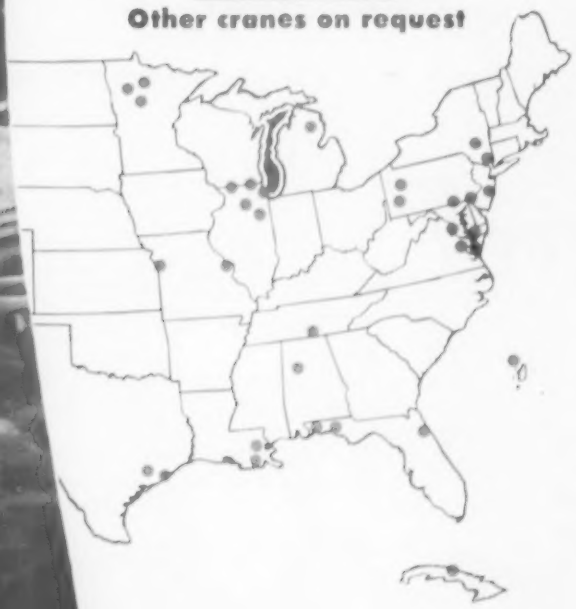
Lee equipment will be shipped new directly to your projects. Call, wire or write today for complete availabilities, locations and cost-saving lease terms.

DON'T BUY — LEASE FROM LEE AND SAVE.

Cranes at locations shown below are available soon.

New 50 to 100 ton cranes available now

Other cranes on request



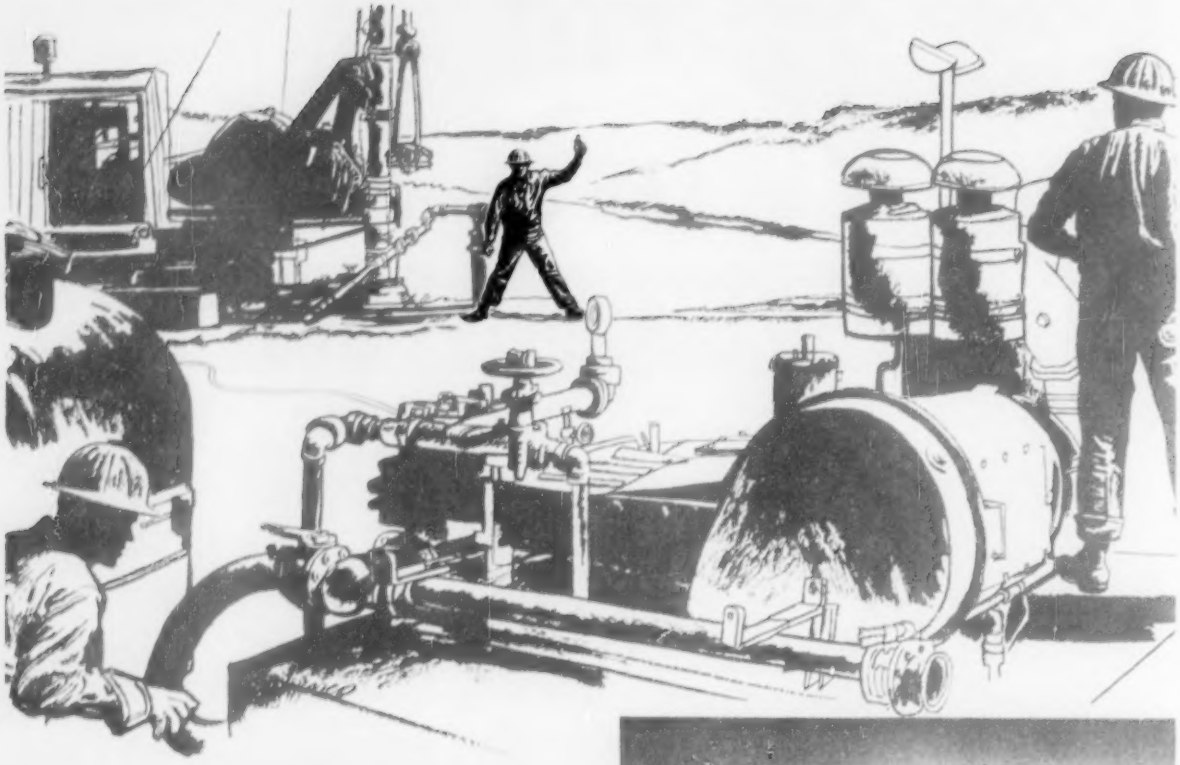
LEE Corporation

Oil, Industrial and Construction Rental Equipment

WA 3-5553 P. O. Box 253 Houston 1, Texas

Affiliated Companies

Lee Construction Company — Lee Shipping Company — American Supply and Equipment Company



Transmits engine power

Smoother than Steam

gets production where others fail

Caddo Chemical Company of Wichita Falls, Texas, reports that its TORQMATIC-equipped unit fractures wells about 75% faster, succeeds in bringing back wells where other units failed.

And Superintendent John Smith says the switch from mechanical drive to his Allison TORQMATIC DRIVE permits him to fracture 6000-foot wells where he was limited to wells 2000 feet deep.

The TORQMATIC-equipped unit costs about 10 to 15% less to operate, cuts maintenance costs, eliminates the need for an extra truck. It pumps 9 barrels of sand-oil mix per minute compared to 3½ barrels for mechanical-drive units. It gets mix pressure up to 5500 psi. in high gear, transmitting power from a GM Diesel to a Western Triplex pump.

Allison's TORQMATIC Converter-Transmission team transmits engine power *smoother than steam*. It delivers more mix at higher pressure to well-bottom sand formations. And it quick-shifts at full throttle—eliminates the danger of sand-oil mix settling in the wells when operators cut power to shift gears.

Owners and operators of drilling rigs, servicing units and fracturing units report Allison TORQMATIC Converters and Transmissions speed operations and cut maintenance costs from spud-in to well-bottom. Ask your engine distributor, equipment manufacturer or dealer about TORQMATIC DRIVES next time you buy. Or get full details from Allison Division of General Motors, Box 894R, Indianapolis 6, Indiana.

AS USUAL . . .

Wilson

IS

First Again!

with the

SLIM HOLE RIG

THAT REALLY COUNTS

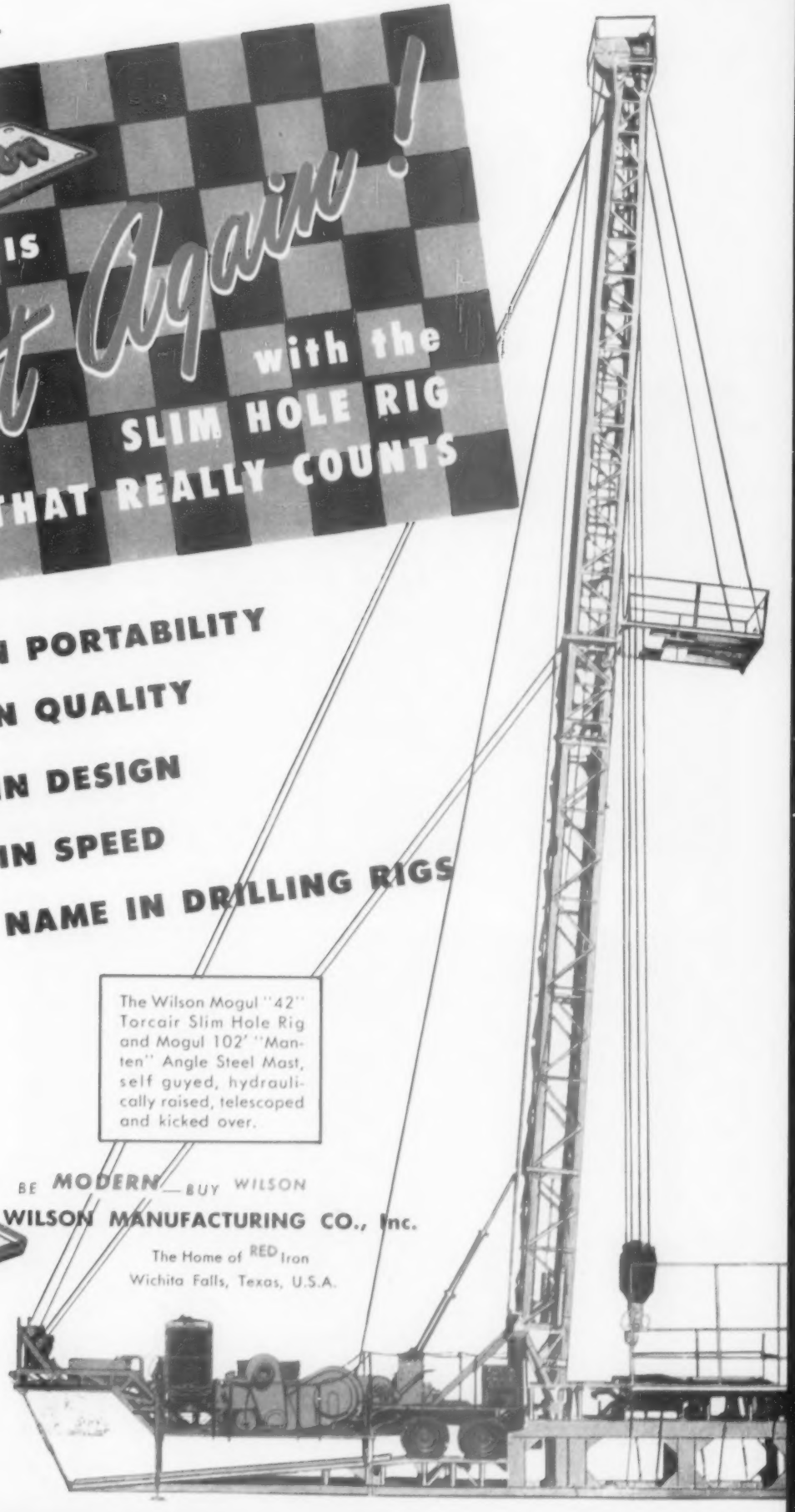
FIRST IN PORTABILITY

FIRST IN QUALITY

FIRST IN DESIGN

FIRST IN SPEED

FIRST NAME IN DRILLING RIGS



The Wilson Mogul "42" Torcair Slim Hole Rig and Mogul 102' "Manten" Angle Steel Mast, self guyed, hydraulically raised, telescoped and kicked over.

BE **MODERN**—BUY WILSON

WILSON MANUFACTURING CO., Inc.

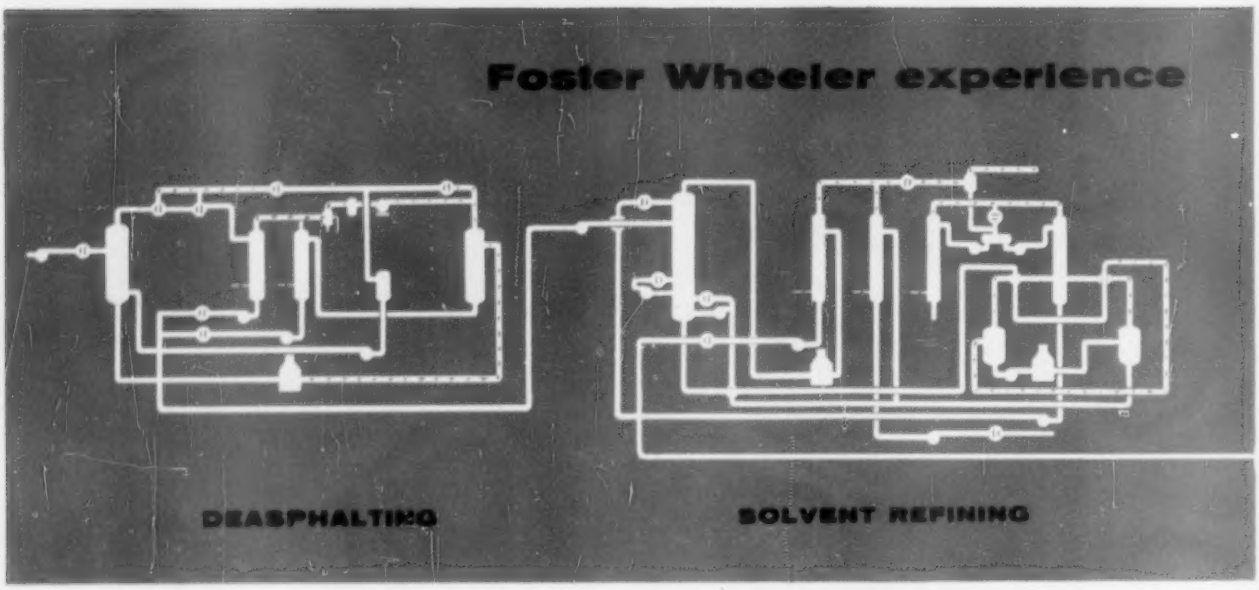
The Home of RED Iron

Wichita Falls, Texas, U.S.A.

Wilson

For Complete specifications, call your nearest Wilson dealer or call the factory direct.

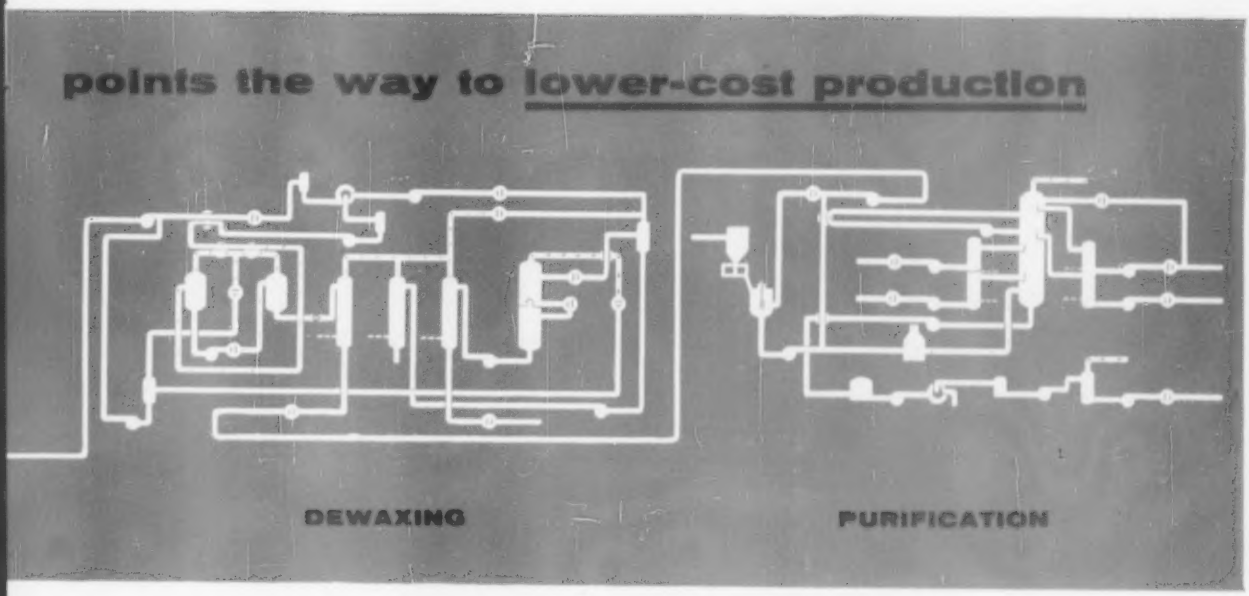
lube



Complete lube oil plant, designed and constructed by Foster Wheeler at England's largest refinery. Process units, in sequence from right to left, are as follows: propane deasphalting, phenol extraction, propane dewaxing and clay contact-vacuum rerun. Foster Wheeler is now building complete lube plants in the United States and Iraq.

oils

points the way to lower-cost production



NEW ADVANCES in refining processes and equipment have resulted in substantial increases in the overall efficiency of lubricating oil production—contributing to higher sustained output of high quality oils at lower unit production cost.

In the construction of new lube oil plants or modernization of existing facilities, Foster Wheeler's long experience in this specialized field is your best assurance of complete satisfaction, from initial planning to final installation and on-stream service. Foster Wheeler process design engineers offer more than 20 years of continuous and cumulative experience in lube oil manufacture. Their intimate knowledge of all phases of design, engineering and construction—plus their close relationship with all licensor companies—can save time, effort and expense in any expansion or modernization program. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

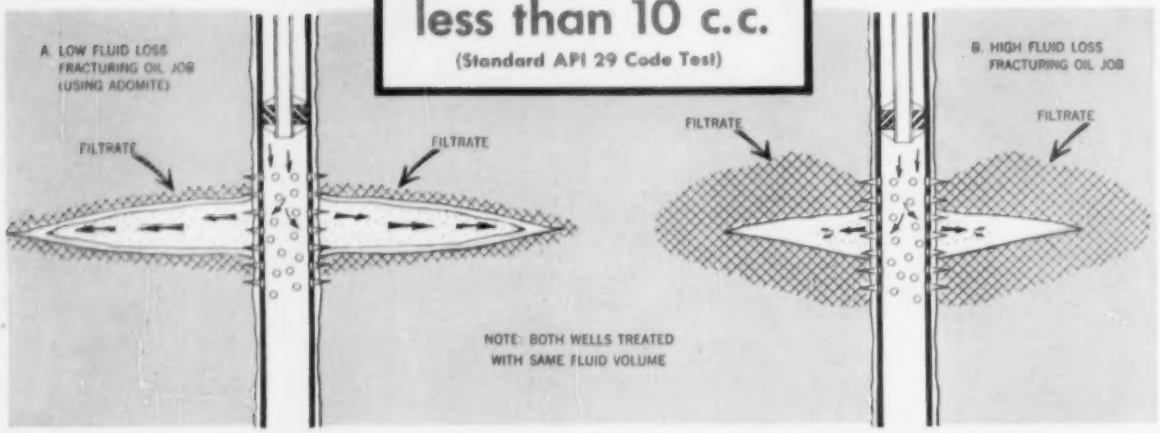
FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

For more productive fracturing . . . least fluid loss

specify Adomite*

Cuts fluid loss to less than 10 c.c.
(Standard API 29 Code Test)


A. LOW FLUID LOSS FRACTURING OIL JOB (USING ADOMITE)
FILTRATE
FILTRATE
B. HIGH FLUID LOSS FRACTURING OIL JOB
FILTRATE
FILTRATE
NOTE: BOTH WELLS TREATED WITH SAME FLUID VOLUME

Adomite is the remarkable fluid-loss control additive that is building production and profits virtually everywhere it is used. Very small amounts of Adomite reduce the API fluid loss of lease crudes to 10 c. c. at most reservoir conditions. With gelled crudes, even smaller quantities are required. *Easy to use*, Adomite is a dry material in flake form that is mixed directly into the crude or gelled crudes on the lease. Only standard mixing equipment is required.

*Trade-mark, Continental Oil Company

Only Adomite can do so many things so effectively . . .

- Seals the fracture face—minimizes fluid loss.
- Longer fractures—deeper penetration of sands.
- Greater sustained production with a given fluid volume at lower cost.
- Saves you money—utilizes lease crudes—less pumping.
- Cleans up quickly—does not contaminate produced oil or the formation.
- Fewer "Sandouts."
- Profitably used for "drilling in" and "work overs."

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Be sure to specify Adomite on your next fracture job

A new SERVICE COMPANY

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Trouble-free performance from the most advanced tools and modern engineering techniques.

GLPS
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Experienced, courteous, competent, and cooperative.

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The highest standards of accuracy and efficient service at the industry's most equitable rates.

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A Subsidiary of Great Lakes Carbon Corporation

There's **MORE** Cooling Surface in these deep-ribbed **MOTORS**

No Day is FRYDAY

with these Allis-Chalmers MOTORS

● Frying of insulation is impossible under normal conditions with the extra-large cooling surface of Allis-Chalmers rib-type TEFC motors. The result—you expect and get longer motor life.

The engineered partner of A-C motors is Allis-Chalmers control.

Get Complete Information

As a new machinery component or as replacement, specify Allis-Chalmers. Discuss your particular application with your nearby A-C distributor, A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

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A-4853

They Say—

New Propaganda Technique

"The modern rule of lobbying in Washington seems to be if you are opposed to a certain piece of legislation but have no really valid or logical objection to raise against it, concentrate on branding it as a 'giveaway' or an attempted 'grab.'

"Either is a prejudicial term calculated to arouse feeling and divert attention from the weakness of your argument. If you also can label the proposed law as a giveway to or a grab by 'special interests,' your chances of successful opposition supposedly are greatly enhanced.

"That is the technique now being used in propaganda attacks against the bill to exempt independent natural-gas producers from federal regulation."

Editorial in Fort Worth Star-Telegram.

Rivalry Intense

"The year ahead will be characterized by further intense competition in the industry. Exploration for and development of new crude reserves has proceeded vigorously. New refining and transportation facilities have been built in many parts of the world. New organizations have entered the industry and are striving for a substantial share of the market, while longer established companies are making strong efforts to hold and increase their market positions. The ultimate beneficiary of all this competition is the consumer.

"Rivalry has spurred still greater research activity and has led to further advances in petroleum technology.

"For example, the potentialities of radioactive substances as an aid in petroleum processing are being actively investigated. Some of the problems involved in drilling in substantial depths of water in the offshore areas are being overcome, although these operations continue to be much more expensive than those on land."

Eugene Holman, chairman of the board Standard Oil Co. (New Jersey) in statement to press.

Outlook Good in Canada

"There were 156 geophysical crews active throughout Western Canada, as 1955 closed. This was 16 more crews than were in the field as 1954 ended and indicated a new high in winter operations.

"Similarly, in the actual drilling of

Oil is Where You Find It!

...and so is Experience!

A complete OIL LOAN dept. with men of practical experience ... 15 directors affiliated with the Oil Industry ... one of the largest Oil Credit files in the nation.

Introducing

R. ELMO THOMPSON

PRESIDENT

... lawyer, Oil Company executive, but for most of his 35 years of distinguished service to the Banking industry and Tulsa, a BANKER ... who can talk YOUR language!

..in TULSA, it's BOTH pleasant AND profitable to

Think...FIRST

FIRST NATIONAL BANK & TRUST CO. of TULSA

Member Federal Deposit Insurance Corporation

WHEN YOU'RE LOOKING for exceptional toughness and durability in a finish for gasoline and oil storage tanks, you'll choose Pittsburgh's brilliant White TANKHIDE.

Here's a tough, long-lasting coating that saves you money in two important ways. Its special pigments and vehicles withstand corrosion and weather. Its high heat and light reflection reduce loss of tank contents caused by evaporation.

White TANKHIDE gives you one-coat hiding—can be brushed on when spraying is impractical. Its quick set and firmness of film during drying period prevent collection of dirt and insects, reduce damage from rain, scuffing and abrasion to a minimum. Self-cleaning action maintains its gleaming whiteness throughout its long life.

TANKHIDE is also available in synthetic gray and black as well as in gray and black oil-base finishes that can be used on metal or wood surfaces with equally good results.

Pittsburgh provides a wide variety of high quality finishes for every need in the petroleum industry. Our wide experience in this field often can save you valuable time and money. Write, wire or phone Pittsburgh Plate Glass Company, Industrial Paint Division, 1 Gateway Center, Pittsburgh, Pa.

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PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

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IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

Meet your **production**

EQUIPMENT SPECIALISTS

in **Houston** *and the*

Texas Gulf Coast Area

When you need equipment for your next well, call your Union Tank sales and service man. DAY OR NIGHT, his years of experience are available to you immediately. This service, combined with dependable Union Tank production equipment, means more profit to you. That's why it will pay you to know:

H. L. "Ike" Poole
Vice President and Regional Manager

C. R. Williams
General Sales Manager

W. F. Broussard, Jr.
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Downtown Houston Office—CApitol 8-8403
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When your next well comes in, call Union Tank for fast, skillful service with dependable follow up on . . .

Welded steel tanks	Indirect heaters
Bolted steel tanks	Emulsion heaters
Wood tanks	Heater tanks
Stairways, walkways	Heater-treaters
Texsteam pumps	Cold sep. & dehyd. units
Vertical separators	Valves and regulators
Horizontal separators	Loading racks

UNION TANK AND SUPPLY COMPANY

P. O. Box 2092, Houston, Texas

Subsidiary of Butler Manufacturing Company
Kansas City, Missouri

exploration and development wells, there were 231 rigs scattered over thousands of square miles probing for elusive crude pools or engaged in development drilling. It is expected drilling will be stepped up. This is likely in northeastern British Columbia where a definite start on the gas pipeline to the coast will accelerate the drilling pace there and in the Peace River area of Alberta.

"There are other projects which will keep construction men busy, such as a chemical plant at Medicine Hat, the gas-processing plant scheduled to go up in the Redwater field, the sulfur plant at Pincher Creek, and no doubt other building programs are in the planning stage. Taken as a whole, all these various undertakings should help make 1956 one of the biggest business years in Canada's history."

Vernon Taylor, member of board Canadian Petroleum Association, in address to Canadian Construction Association, Winnipeg.

Diagnosis Praised

Dear Sir:

I assume that you will have varied reactions to your article "Drilling Contractors Caught in Switch" that appears on page 68 of the January 16th issue of The Journal. But, for my money, it is the truest and best description of the illness being suffered by the contract drilling industry that has been written and published, and there have been many from both within and without the industry.

It certainly appears that we have become so sick that we can't locate the pain, and we are now too frightened to call a doctor. It isn't a pleasant thought, but under the old "rugged individualistic" structure of our industry, it is obvious that we have to get worse before we get any better.

H. Don Johnson
Executive Vice President
Carl B. King Drilling Co.
Midland, Tex.

Future Role of Atom

". . . It would seem that the industry has little to fear from the atom—that in the field of central station power, perhaps 10 or 15 per cent, at the most, will be supplied by atomic energy in 1975—that in the foreseeable future, in the field of transportation, nuclear power has its first appeal to the military—both at sea and in the air.

"It has some prospect of being useful in the commercial field for surface vessels although the costs presently seem to make this application commercially unwise. As for the railroads, the incentive for unlimited range is

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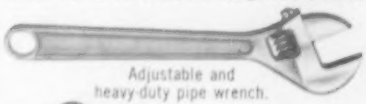

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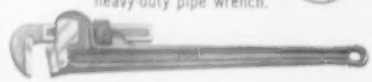

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not present, and the dangers of radiation are great.

"And as for our highways, forget it." —*Gordon Dean, associate of Lehman Brothers, New York, in address before convention of Pipe Line Contractors Association of America, Boca Raton, Fla.*

CALENDAR OF EVENTS

FEBRUARY

15-17 National Association of Corrosion Engineers Short Course for Pipeliners, Mayo Hotel, Tulsa.

15-17 American Society of Civil Engineers, construction division pipeline conference, Baker Hotel, Dallas.

16 Petroleum Equipment Suppliers Association, Pacific district annual meeting, Ambassador Hotel, Los Angeles.

19-25 American Institute of Mining and Metallurgical Engineers, annual meeting, Hotel Statler, New York City.

24 Natural Gasoline Association of America, Permian Basin meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Institute of Chemical Engineers, Statler Hotel, Los Angeles.

27-29 American Association of Petroleum Geologists, Rocky Mountain Section, Auditorium, Denver.

27-Mar. 3 International course on atomic energy, sponsored by National Industrial Conference Board, Westchester Country Club, New York.

MARCH

1-2 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

7-9 American Petroleum Institute, Division of Production, Southern District meeting, Plaza Hotel, San Antonio, Tex.

7-9 Society of Exploration Geophysicists, 9th annual midwestern meeting, Texas Hotel, Fort Worth.

12-16 National Association of Corrosion Engineers, annual convention, Statler Hotel, New York City.

19-21 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

21-23 American Petroleum Institute, Division of Production, Southwestern District meeting, Texas Hotel, Fort Worth.

24 North Texas Oil and Gas Association, annual meeting, Wichita Falls, Tex.

29-30 American Institute of Mining, Metallurgical, and Petroleum Engineers, Dallas section, conference on economics and valuation, Statler-Hilton Hotel, Dallas.

APRIL

2-3 Petroleum Engineering Conference on electrical and radioactivity logging, University of Kansas, Lawrence, Kans.

3-5 Annual Corrosion Control short course, University of Oklahoma Extension Study Center, Norman, Okla.

4-6 American Gas Association, general management conference, Conrad Hilton Hotel, Chicago.

4-6 American Petroleum Institute, Division of Production, Mid-Continent District meeting, Broadview Hotel, Wichita, Kans.

This Giant Among Utilities ...Relies on Layne!

IN PRODUCING 9.4 billion kilowatt hours of electric energy yearly, the generating plants of Philadelphia Electric Company, industrial giant of the Delaware Valley, need 3.25 billion gallons of water—daily. Borrowed from the Delaware and Schuylkill Rivers, this astronomical quantity of water is vital to operation.

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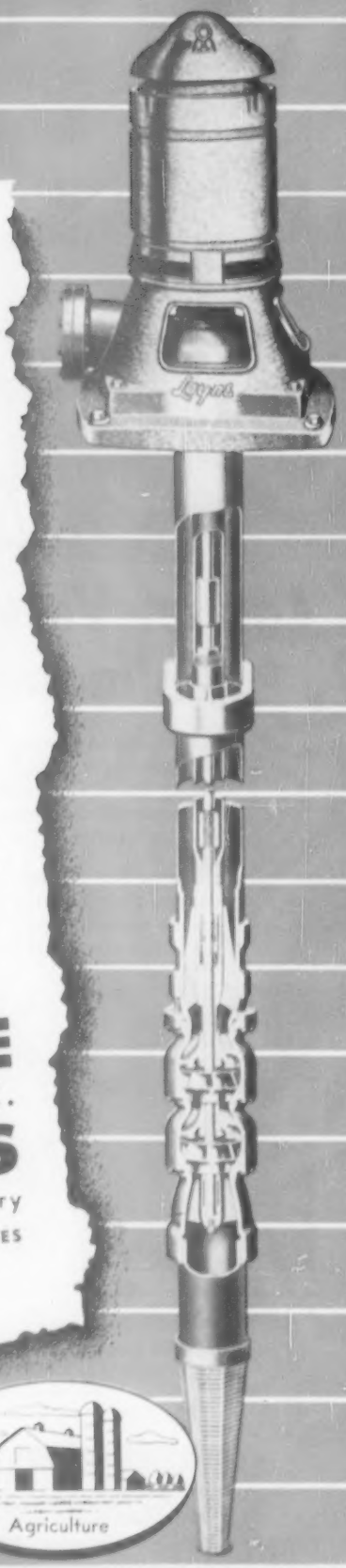

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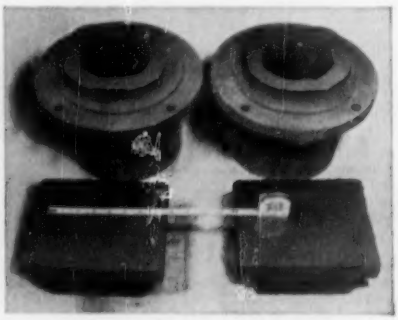
Longer Valve Life with Colmonoy Hard-Facing

Catalyst slide valve gates, throats, and bodies last longer—up to five times longer, when hard-faced with Colmonoy No. 1 electrodes. The success of Colmonoy No. 1 in resisting erosion by catalytic fluids has made it the standard material for hard-facing slide valves by many maintenance shops, job shops, and valve manufacturers.

Colmonoy No. 1 electrodes' new metallic coating improves arc stability, permits vertical welding, and eliminates weld cleaning between successive passes. This reduces welding time to cut the already low cost of reclaiming valves with Colmonoy hard-facing.

A valve slide being hard-faced with Colmonoy No. 1 electrodes.



Two 8 inch slides and throats after being reclaimed with Colmonoy No. 1 (shown finish ground).

Write for Colmonoy Hard-Facing Manual #79 which describes all of the Colmonoy hard-facing alloys and methods.

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8-13 Amer. n Chemical Society, general meeting, Dallas.
9-10 Texas Petroleum Research Committee, Ninth Oil Recovery Conference (Symposium on Natural Gas in Texas), Texas A. & M. College, College Station, Tex.
11-13 Natural Gasoline Association of America, Texas Hotel, Fort Worth.
14-15 Southern Gas Association, conference on use of electronic computers by engineering personnel, Hilton Hotel, El Paso.
14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel & Club, Boca Raton, Fla.
15-17 Texas Independent Producers and Royalty Owners Association, Statler Hilton Hotel, Dallas.
16-18 American Society of Mechanical Engineers, first Gas Turbine Power Conference, Hotel Statler, New York.
17 American Institute of Chemical Engineers, Philadelphia-Wilmington section —University of Pennsylvania, fourth annual meeting of "Experience in Industry" series.
17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.
18-20 American Petroleum Institute, Division of Production, Rocky Mountain District meeting, Cosmopolitan Hotel, Denver.
18-20 National Petroleum Association, semiannual meeting, Cleveland Hotel, Cleveland, Ohio.
19-21 Gas Appliances Manufacturers Association, annual meeting, The Greenbriar Hotel, White Sulphur Springs, W. Va.
23-25 Southern Gas Association convention, Dallas.
23-26 American Association of Petroleum Geologists and Society of Economic Paleontologists, annual meeting, Conrad Hilton Hotel, Chicago.
24-25 Pacific Coast Gas Association, Supply and transmission conference, Thunderbird Hotel, Las Vegas, Nev.
25-27 American Petroleum Institute, Division of Production, Eastern District meeting, Deshler-Hilton Hotel, Columbus, Ohio.
25-29 World Oil Exposition, Houston.
30 May 1 Independent Petroleum Association of America, semiannual meeting, Statler Hotel, Los Angeles.
30 May 4 American Petroleum Institute, Safety and Fire Prevention midyear meeting, Warwick Hotel, Philadelphia.
30-May 5 International Course on Atomic Energy, sponsored by National Industrial Conference Board, Westchester Country Club, New York.

MAY

6-9 American Institute of Chemical Engineers, Roosevelt Hotel, New Orleans.
10-11 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.
10-11 American Gas Association, Gas Supply, Transmission, and Storage Conference, Conrad Hilton Hotel, Chicago.
14-15 American Institute of Mining, Metallurgical & Petroleum Engineers, Kansas regional meeting, Broadview Hotel, Wichita.
14-17 American Petroleum Institute, Division of Refining, midyear meeting, Montreal.
16-18 American Gas Association, Chemical, Engineering, and Manufactured Gas

Production Conference, Benjamin Franklin Hotel, Philadelphia.

17-18 Rocky Mountain Petroleum Sections, joint meeting, Gladstone Hotel, Casper, Wyo.

22-24 Pennsylvania Gas Association, Pocono Manor Inn, Pocono Manor, Pa.

24-25 Natural Gas and Petroleum Association of Canada, Sheraton Brock Hotel, Niagara Falls, Ont.

24-25 Western Petroleum Refiners Association, Michigan Regional Meeting, (location to be announced).

24-25 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington, Ky.

28-30 Chemical Institute of Canada, 39th annual conference and exhibition, Sheraton-Mount Royal Hotel, Montreal.

30-June 1 Texas College of Arts & Industries, eleventh annual short course in Gas Technology, Kingsville, Tex.

JUNE

13 Pennsylvania Grade Crude Association, thirty-third annual meeting, Bradford, Pa.

17-22 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Atlantic City, N. J.

21-22 Western Petroleum Refiners Association, regional technical—industrial relations meeting, Broadview Hotel, Wichita.

17-23 World Power Conference, Vienna.

24-25 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

26-29 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que. (see book).

28-30 Rocky Mountain Oil and Gas Association, board of directors, Hotel Utah, Salt Lake City.

SEPTEMBER

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

OCTOBER

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-Nov. 1 Society of Exploration Geophysicists, national convention, New Orleans.

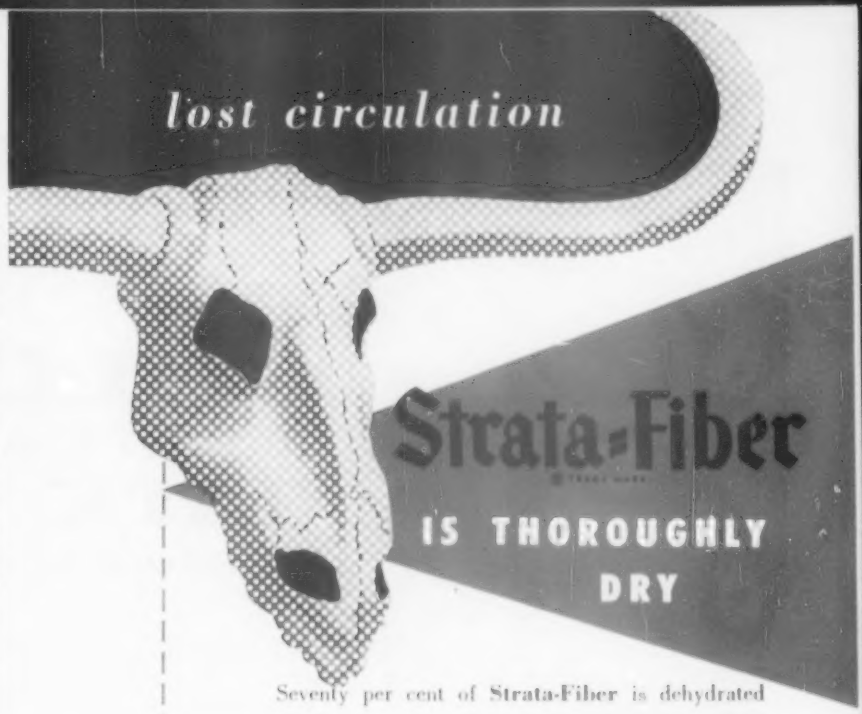
NOVEMBER

12-15 American Petroleum Institute, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

lost circulation



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Seventy per cent of **Strata-Fiber** is dehydrated fibers from the inner rind of sugar cane bagasse. But these fibers have been so thoroughly dried that you buy *more* active lost circulation material per pound than with any similar product. This extra drying plus the fact that **Strata-Fiber** is made from the tough inner rind makes it your best buy in a fibrous lost circulation material.

Strata-Seal

Strata-Seal has both a plugging and a bridging action. The perlite particles pack tightly in the fractures of the formation. This tight packing strengthens the troublesome formation making it more impermeable, thereby less susceptible to reoccurrence of lost circulation. Can be obtained from drilling mud distributors.

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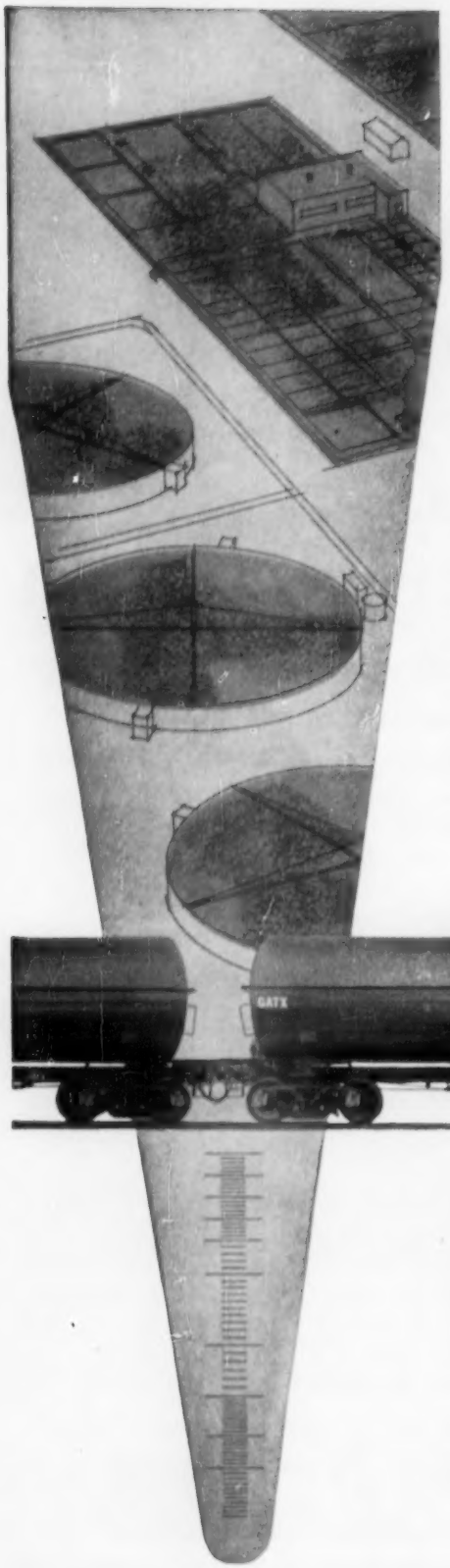

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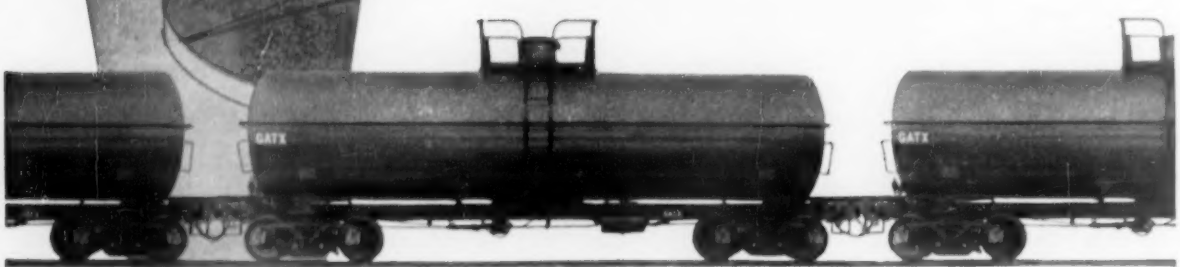
There's a GATX tank car that's built or can be built to meet your bulk liquid shipping needs. You can choose from over 200 types in the fleet of 48,000 cars designed, built and operated by General American. General American's 38 repair shops service these cars quickly and efficiently for you. For the *right* tank car for your product, write or call your nearby General American district office.



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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Good Scouts

OIL scouts down Louisiana way found the going tough when drilling rigs moved so far offshore that the scouts couldn't scout them with their spyglasses. So, in traditional American fashion, they formed an association to do something about it.

The result is now a going concern, known as the Louisiana Offshore Oil Scouts Association, with 15 members and more in prospect. It's exclusive, too; a member can't belong to any ordinary, shorebound scout check.

The reason for the exclusiveness is not entirely snobbishness. These offshore scouts claim to be a special and superior breed. In addition to all the ordinary things that ordinary scouts scout on land, these scouts have to report to their companies such information as whose crew boat was seen cruising in such and such a latitude and longitude, where seismic shooting is suspected, and what types of barges, drilling rigs, and floating equipment are being used. What dope they can't glean from each other at their weekly meetings they have to get as they can, and the best way is to fly all over the Gulf of Mexico with a good pair of binoculars.

Added to all the specialized knowledge of geology and drilling methods that any oil scout is supposed to have, these qualifications make the offshore scouts eligible for rating as first-class eagle sea scouts with extra merit badges.

Good People Are Scarce

COMPETITION is mighty keen in the marketing end of the oil business, with marketers going to almost any extreme to keep customers for their gasoline, but Shell Oil Co. has now taken the ultimate step. It is conducting a campaign to keep its customers from annihilating themselves.

At least that might be one explanation for the big advertising campaign Shell is running in newspapers this month.

In a series of full-page ads, Shell is presenting some do-it-yourself tests for automobile drivers, giving simple ways by which an automobile driver can check on his driving knowledge and the speed of his reactions at the wheel. The tests were worked out in cooperation with the Automotive Safety Foundation, and promise to be a lot more effective than the tired old slogans like "Drive Safely."

It's a mighty impressive and constructive program, and we hope it works. Good people are scarce, as the old saying goes, and customers are the best people the oil industry has. It's a horrible thought that our customers are in danger of killing themselves all off by mass suicide at the wheel. The oil industry would be in a bad way without any motorists left.

In addition to keeping its customers alive so they can buy more gasoline, Shell apparently feels that the oil industry, which fills up the tanks with such potent suicide juice, has an obligation to help people use it with more common sense. That's reasonable. If the ad writers for all gasoline sellers should get into a competitive race to see who can promote highway safety the most, it might result in preserving enough customers for all of them.

Freeze and Antifreeze

SPEAKING of the weather (and who isn't these days?) you may think it's cold where you are but just think of those poor so-and-sos up in northern Canada. Our spies have just sent in some intelligence on oil operations in the subarctic.

In northern British Columbia it's so cold right now that even natural gas freezes unless it's doped up with antifreeze. At first we thought this was one of those tales like a man's words freezing solid and they'd have to be brought inside and thawed out before others could hear what he said. But it was explained that liquid hydrocarbon in the gas solidifies and stops the flow from the wells. So crews are experimenting with filling the wells full of ethylene glycol antifreeze. A good trick if it works.

But the cold is welcomed by drillers on a lake near Edmonton. To save the trouble of getting an offshore barge for drilling in the lake bottom, the crew rigged up on the solid ice. Since the well has to be completed before a thaw liquefies the whole project, those boys are racing both the calendar and the thermometer.

—*Henry D. Ralph.*

Controlled Fissuring Power!

Welex BEAR GUN

(FORMATION FRACTURING TOOL)

The gun that shoots 'round a corner!

Welex called this mighty innovation the Formation Fracturing Tool when they developed and introduced it two years ago — you, in the field, gave it a new name after using it — the Bear Gun. By any name — oil operators everywhere are calling more and more for the tool's great fissuring power in their tough wells. Wherever the formation or a heavy invasion of mud or cement hinder the flow, call Welex for the Bear Gun. Each shot will give you a large entrance hole — deep into the formation — and the extensive fissuring that reduces pressures and makes your fracturing job a success!

Perforating is no sideline with WELEX!

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We'll need all these wells and more, too

WE are planning to drill 58,000 wells in this country this year—a tremendous number. Is it too many? The answer must be no as long as demand for oil keeps growing and unless the volume of reserves proved per well drilled suddenly increases.

The best thing about the 1956 program is the heavier emphasis on exploratory drilling. While all wells will be up 2.4 per cent over the preceding year, wildcats will be up 7.2 per cent and development wells up only 1.1 per cent. This is by far the biggest percentage gain in wildcats during the past 5 years. It will bring the wildcat ratio to 22.7 per cent of all wells—almost equal to the 1951-52 peak.

A PARADOX that laymen have difficulty understanding is that during the past several years we have had a surplus of crude-producing capacity but a declining ratio of proved reserves—too much oil but not enough at the same time.

A partial corrective for this—perhaps the only corrective within immediate control of oil operators—is to drill a higher precentage of wildcats. The prospect that this is being done now is welcome news.

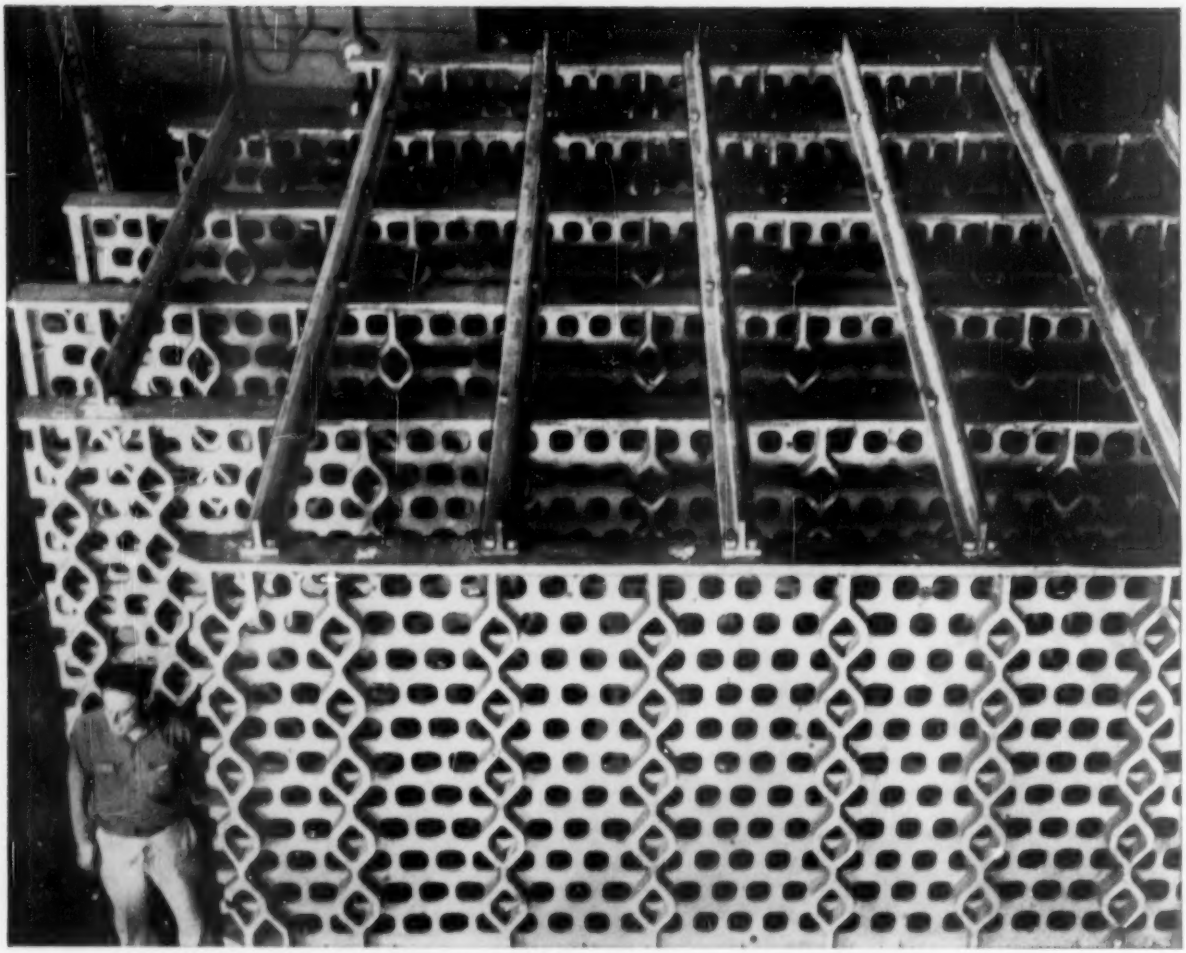
A slackening off in the rate of development drilling will tend to prevent an increase in our unused producing capacity, which currently is the cause of many difficulties. At the same time, demand for crude keeps climbing. Assuming that imports don't grab off all this increase, domestic production may be close to MER's within a few years.

The industry must plan in terms of a few years because it normally takes that long to bring a new field to substantial production. This year's wildcats will discover oil which for the most part won't come on the market for 2 or 3 years and by then the demand for domestic crude should be considerably higher.

Only time will tell whether these new wildcats will prove up reserves as fast as demand increases. Discovery rates of the last couple of years indicate that they may not. If not, wildcatting will have to be stepped up even more, and probably development drilling also.

THERE IS A MAXIMUM RATIO between crude production and proved reserves. Some say the United States could not long sustain annual production much above 8 per cent of reserves. So if demand increases faster than discoveries, our presently embarrassing excess capacity could soon disappear.

So we need to find more oil. And—unless science unveils some marvelous new finding method—the only way to do it is to wildcat. That's why the current increase in the wildcat ratio is healthy and encouraging, and why total drilling probably will keep going up and up for many years.



Heat-resisting stainless alloy containing 25% chromium and 12% nickel makes possible cast tube supports that meet two basic demands: (1) high resistance to creep, (2) resistance to oxidation at temperatures upward of 1300°F. These type "HH" tube supports for a petroleum refinery were cast by Duraloy Company, Scottsdale, Pa., and assembled by welding. Total weight: 55,000 lbs.

Chromium-Nickel alloy tube supports carry load... resist creep and corrosion above 1300°F

THE HIGH-TEMPERATURE STRENGTH of these cast stainless tube supports permits years of use under normal operating conditions.

Even under abnormal conditions, such as a fire, these stainless castings provide adequate strength over a time period that usually allows regaining control.

Key to their load-carrying ability . . . and to their oxidation-resistance at high temperature . . . is a combination of 25% chromium and 12% nickel.

Cast heat-resistant nickel alloys of this type show more than satisfactory resistance to oxygen-sulphur compounds, chiefly sulphur dioxide, and to other agents that attack tube supports in fired coils.

Nickel alloyed irons and steels prove their dependability in all sorts of refinery applications. Whenever you face a problem where you need greater strength, or resistance to corrosion or abrasion at normal, high or low temperatures, let's talk it over. We may be able to help you dispose of a troublesome difficulty.

INCO

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Current and significant in . . .

The Industry This Week

Labor

• **The pattern is being set for 1956 wage increases** in the oil industry. Majors are offering a minimum of 15 cents an hour or $26 a month. Others are expected to join as unorganized workers and small unions accept. P. 54.

A king-sized challenge to O.C.A.W.'s claim of being the industry's dominant union is shaping up. A group of 11 independent unions representing 60,000 workers has organized an alliance. Its goal is 400,000 members or nearly twice present size of O.C.A.W. P. 57.

Government

• **A diplomatic squeeze is being fashioned for U. S. oil firms** operating in the Middle East. Oil policies were paramount in discussions between Britain's Eden and President Eisenhower. From the talks, one trend is apparent: Britain wants U. S. to help control Saudia Arabia's spending of its huge oil royalties. P. 60.

Voting starts on the Harris-Fulbright bill this week. First tests will come on amendments being offered by opponents. Two decisive votes are expected by midweek. They will decide the measure's fate. P. 68.

Industry

• **The key to getting more and better engineers:** Upgrade science and math teachers in high school, improve liaison between industry and schools so studies can be geared accordingly. These and other solutions are suggested by an educator in the fourth of five articles on the shortage of engineers. P. 58.

Processing

• **Standard of Texas plans to expand its El Paso refinery** from 36,000 to 61,000 bbl. daily. An expansion project by another Socal subsidiary will make increased crude available. Pasotex will boost capacity of its Wink-El Paso crude line from 55,000 to 80,000 bbl. daily. P. 56.

Esso Research & Engineering is pioneering in centralized control of gaging, blending, and storage at a big eastern refinery. P. 66.

Stanvac is starting a $20 million modernization at its 71,000-bbl. daily Sumatra refinery. P. 77.

Exploration

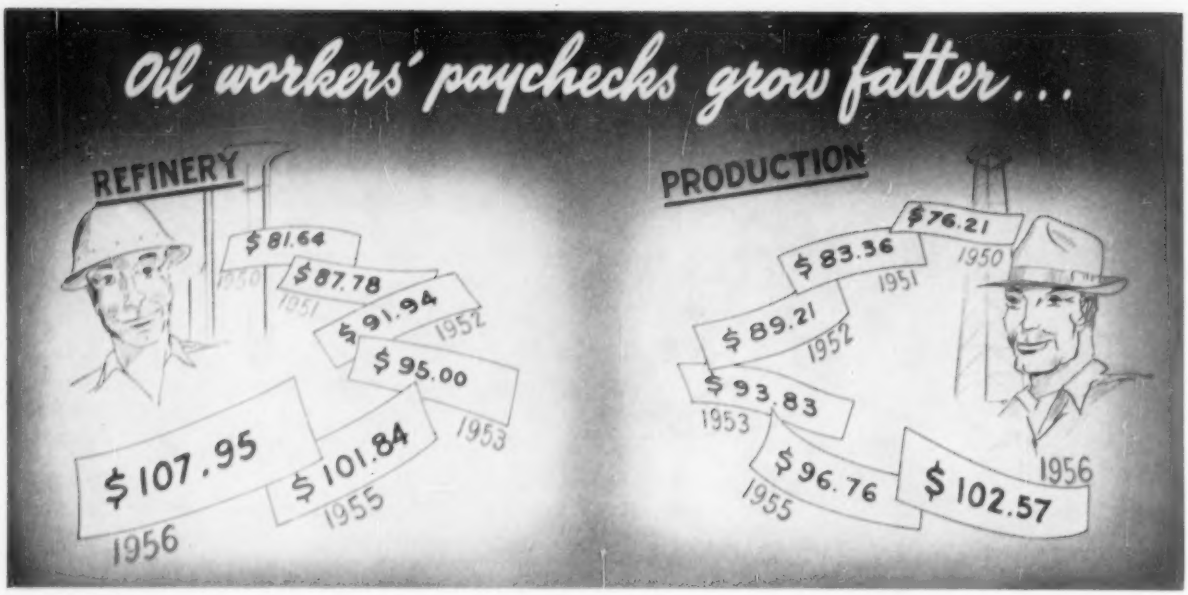
• **Kuwait is preparing to auction offshore concessions.** They'll lie only a few miles from the world's most prolific producing areas. Problems to be solved before bids will be accepted are a boundary issue with Iraq and a decision on extent of Kuwait Oil Co.'s rights. P. 76.

A new operator will enter Alaska if the U. S. Government approves. Colorado Oil & Gas Corp. has an agreement to develop the 1,250,000 acres controlled by Yakutat Development Co. The block is adjacent to holdings of Phillips Petroleum Co. at Icy Bay. P. 59.

Troubles are plaguing two deep wells which hold records.

In the Louisiana marshes, crews of Richardson & Bass on the world's deepest well are fishing. Drill pipe stuck in the open hole below 21,809 ft. P. 72.

In Grady County, Oklahoma, testing operations were blocked at British American's well by a faulty cement job. If completed, the well would be Oklahoma's deepest producer. P. 73.



Oil Launches New Round of Wage Hikes

- **Majors setting pattern by offering 6 per cent raises; acceptance is quick by unorganized workers, small unions**
- **But big labor leaders expected to bargain for higher goals; some firms awaiting outcome before making offers**

WORKERS in the nation's booming oil industry appear assured of a greater share in prosperity. Major companies nearly across the board are offering wage increases for 1956—labor's sixth in the last 6 years.

Most of the increases offered so far are general. They fit this pattern: A 6 per cent raise or 15 cents an hour whichever is greater for hourly employes and 6 per cent or $26 monthly for salaried workers.

Unorganized workers or these represented by small independent unions in some instances have accepted quickly. The larger independent unions and the big Oil Chemical and Atomic Workers International Union are considering the offers.

Big labor, however, warns the pay hikes fail to meet its minimum expectations. Its spokesmen had set their sights for higher wage goals. But for the moment they are studying the proposals and keeping their own counsel.

What it means . . . The pay raises will cost the industry more than $3 million weekly if they are universally offered and accepted.

This is a conservative minimum cost estimate. It is based only on the 202,000 workers employed last fall in refining and 304,900 in crude-oil and natural-gas production. It does not cover costs of more pay for the 25,800 workers in the pipeline industry nor some administrative personnel. Costs of overtime and of expansions in the work force also are not reflected.

The increases would raise the average hourly wage rate in refining to at least $2.64 from $2.49 and the rate for production workers to $2.51 from $2.36.

This means average weekly pay checks of $107.95 for refinery workers and $102.57 for production employes. Both categories already are paid far above the average earned by workers in other manufacturing industries.

The strategy . . . The wage moves are viewed as oil management's answer to organized labor's much publicized campaign for a substantial pay raise in 1956.

Some observers think management may have stolen some thunder from labor's campaign with a generous offer. The 6 per cent raise ranks among the best gained by workers since the Korean War.

Labor leaders privately assess management strategy like this: The companies made their first moves to production and office workers where unions are weakest, or where the offers would get quicker acceptance. Then when management comes to bargaining with union representatives in the refineries it would be in a stronger position. The unions would be faced with the fact that a large segment of the industry's work force already had accepted a uniform basic wage rate.

Will unions take it? . . . There are indications, however, that management and the unions may not be too far apart.

At least O.C.A.W. leaders are not tossing the offers out the window and countering with steeper demands.

O. A. (Jack) Knight, O.C.A.W. president, says none of the proposals submitted to locals of his union has been accepted. He emphasizes, however,

Oil's 10-Year Wage Spiral

Year—	Refining hourly av.	Production hourly av.	All mfg. hourly av.
1946	1.424	1.307	1.086
1947	1.566	1.473	1.237
1948	1.788	1.667	1.350
1949	1.874	1.778	1.401
1950	1.929	1.815	1.465
1951	2.08	1.95	1.59
1952	2.20	2.09	1.67
1953	2.32	2.21	1.77
1954	2.37	2.27	1.81
1955	2.49*	2.36*	1.91*
1956†	2.64†	2.51†	

*October average, U. S. Department of Commerce figures. †Current industry offers.

"this should not be interpreted as a turndown. Negotiations are continuing in good shape."

Knight adds that the pattern is lower than the amount he believes the union's 100,000 oil workers throughout the nation are entitled to receive. But just how the 6 per cent increase measures up to the union's demands is not clear yet.

The O.C.A.W.'s 54-member bargaining policy committee set a target amount last November. But it was never disclosed publicly "in the hope that such action would facilitate negotiations." The aim apparently was to reveal the goals to individual management at the proper time and negotiate without too much fanfare.

The oil workers' last increase—a 10-cent-an-hour raise—was granted last March. Knight said at that time he considered the boost one which was due in 1954 but received in 1955. Later he announced goals of the current drive would be raises "earned and due in 1955, plus 1956 increases."

There is a possibility union locals in their bargaining may accept the 6 per cent general increase if it is tied into increases in shift differentials and larger fringe benefits. Thus the contract package itself might be nearer O.C.A.W.'s goal.

Tight discipline . . . But Knight says O.C.A.W. is keeping close watch over affairs of its locals.

Individual bargaining groups are reporting the wage offers to headquarters in Denver for review by the union's high command. Knight says this procedure will "prevent any one bargaining group from inadvertently signing a contract for an inferior wage increase and possibly setting thereby an industrywide pattern lower than could otherwise be set."

There are 500 oil company bargaining units in O.C.A.W. Most of the workers are employed in refineries with the remainder in pipeline, oil field, and wholesale marketing classifications.

Most contracts covering refinery workers either have terminated or are subject to termination on short notice. The union estimates that by May almost 90 per cent of all O.C.A.W. agreements will have expired. The rest will run out by July.

The parade . . . First wage offers came almost simultaneously from Standard Oil Co. (Ind.) and Standard Oil Co. (N. J.) and its affiliates.

Indiana Standard's offer went to its 25,000 union and nonunion employes in 15 midwestern states. But two major independent unions representing most of the company's organized workers reportedly rejected the proposal and asked for further bargaining.

Spokesmen for the Central States Petroleum Union and Independent Petroleum Workers of America said the offer did not meet their major demands. I.P.W.A. had asked 30-cents-an-hour increase and C.S.P.U. 20 cents. Both also had other demands on shift differentials, holidays, and settlement of inequities.

Jersey Standard's offer met with greater acceptance. Independent unions were reported taking the proposal at Esso Standard plants at Bayway, N. J.; Baltimore, Charleston, S. C.; and Baton Rouge, as well as Bayonne marine and New York waterfront facilities. Several other Esso Standard manufacturing and sales units were considering the offer.

Carter Oil Co., a Jersey subsidiary, buttoned up an agreement on the 6 per cent basis with all its employes except 305 members of the O.C.A.W. unit at its Billings, Mont., refinery. The same offer was made to the Billings unit, which is reported considering it.

Humble Oil & Refining Co., another Jersey affiliate, made the same offer for salaried workers and nonunion employes. The company announced it is willing to extend the increase to its union men. Some Humble locals were reported taking the offer but no action was taken immediately by the 4,600 union workers at Humble's big Baytown refinery.

Others reported making the blanket wage offer include Gulf Oil Corp., Atlantic Refining Co., Socony Mobil Oil Co., Inc., American Oil Co., and Pan American Production Co.

Socony Mobil limited its offer to employes making less than $25,000 yearly. Gulf's limit was $15,900.

The Socony Mobil offer was accepted by independent unions in plants at Paulsboro, N. J., Brooklyn, Providence, R. I., and Buffalo, N. Y.

Meanwhile, many other majors report they are watching the reception given offers in other companies or they are considering making similar offers themselves. These include Stanolind Oil & Gas Co. and its affiliates, Shell Oil Co., The Texas Co., Ohio Oil Co., Continental Oil Co., and Magnolia Petroleum Co.

West Coast companies, which historically wait for wage patterns to develop in the East before acting, said no upward wage movement is under way or planned.

W. C. Stevenson, vice president in charge of labor relations for Union Oil Co., said: "We meet the competition of the area we operate in." He spoke only for Union but in effect summed up views of other West Coast firms.

Tanker Fleet Busy

● But U. S. tonnage drop puts this country behind Great Britain and Norway

WASHINGTON.—More than 98 per cent of the privately owned oceangoing U. S. tanker fleet was active at the start of 1956, the American Merchant Marine Institute reported last week.

But the institute noted that our tanker fleet no longer leads the world. It has dropped to third place, behind Great Britain and Norway.

A cut of more than 10 per cent in the size of the fleet last year, together with increased freight rates and the use of privately owned tankers by the Military Sea Transportation Service, combined to reduce inactive tonnage to a post-Korean low.

There were 362 vessels of 6,016,584 deadweight tons in the U. S. fleet January 1. There was a net loss of 43 vessels and some 618,000 tons in 1955. Three new vessels were added during the year, but 46 were removed, 25 by sale or transfer abroad, 3 by scrapping, 1 by conversion to dry cargo, 1 by transfer to inland operation, 6 by forfeiture to the Government, and 10 by trade-in to the Maritime Administration.

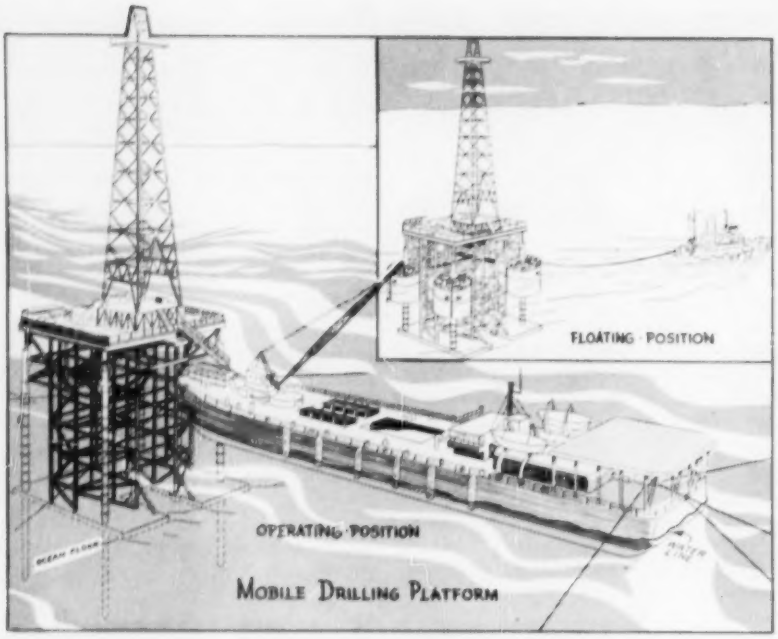
U. S. fleet shrinks . . . Our tanker fleet has fallen by 1,200,000 tons or 16.5 per cent since January 1949. But it is still 1,800,000 tons or 42.7 per cent greater than in 1939.

The big problem facing the tanker industry is block obsolescence, the report warned. Over 85 per cent of the fleet will need replacing 5 to 9 years hence if we are to maintain it at anywhere near its present size.

The Defense Department estimates this country should have not less than 9,636,000 tons of active tankers in our merchant marine to meet initial defense needs in an emergency. Our present fleet is 37.5 per cent below this minimum.

The institute's analysis shows that operations of U. S. tankers in foreign waters are shrinking. There was an increase of 3.2 per cent last year in tonnage in coastal and intercoastal trade, to 4,335,000 tons. Tonnage in the U. S. territories increased one-third, to 120,000 tons.

Much of the import oil movement has been lost to other nations. U. S. tankers carried only 23 per cent of the oil imported in the first 9 months of 1955, as against 76 per cent in 1946. Only 11 per cent of the exported oil was carried in U. S. vessels.



Humble uses own design in . . .

. . . New Mobile Platform

HOUSTON.—Humble Oil & Refining Co., which has eight stationary drilling "islands" in the Gulf of Mexico, has invited bids for construction of its first mobile platform.

The versatile unit incorporates several features not previously tried in offshore drilling structures.

If successful, such units gradually may replace fixed platforms in Humble's future offshore operations.

The portable unit was designed by Richard P. Knapp, Houston, a supervising engineer in Humble's petroleum engineering division. Consulting engineers on the project were Parsons, Brinckerhoff, Hall & MacDonald, New York.

Deadline for submitting bids on construction of the unit is February 20. Contract is expected to be let soon after that date.

Four detachable floats will provide the buoyancy required in towing the unit from one well site to another. By moving the derrick, draw works, engine, and substructure, six wells may be drilled from one location.

Sixteen steel columns will support the working deck. These columns will extend to a big steel mat which will rest on the bottom of the sea when the unit is in operation.

How platform is anchored . . . Each of the corner columns will contain a steel spud to anchor the platform to the ocean floor.

Hydraulic jacks will force the four spuds as much as 65 ft. into the gulf floor. When the unit is ready to be moved to another location, the jacks will reverse their procedure and withdraw the spuds.

Transport floats will be attached to the corner columns while the unit is being moved. They will be water-tight cylinders 36 ft. in diameter and built in two sections. With hinges on one side and pins on the other, the floats will be easily attached and removed from around the corner columns.

The floating cylinders will provide the necessary buoyancy to raise the mat from the bottom and to support the platform while it is being towed. When the structure reaches location, the floats will be flooded with sea water to force the mat to a stable position in the mud. Once the platform is secured to the gulf floor, water will be pumped from the transport floats. The floats then will be removed until they are again needed to raise the structure.

Depth capacity . . . As designed, the platform would operate in water from 30 to 55 ft. deep. By adding 15-ft. extensions on the columns supporting the working deck, the unit could be used in water 70 ft. deep.

Working deck of the Humble platform would be comparatively small—80 ft. long and 75 ft. wide. In addition to drilling equipment, the deck will have a diesel-driven generator to furnish power for raising and lowering the platform.

A tender will provide living quarters for the crew and storage space for drilling supplies.

Humble has had several gulf wells drilled from portable platforms owned and operated by drilling contractors. But the company has done its own offshore drilling from stationary platforms serviced by tenders.

Besides its eight tenders now in use, Humble is converting four more L.S.T.'s for such service. The company expects to have all 12 ready by July.

Refinery, Pipeline to Expand

LOS ANGELES.—A major refinery and pipeline expansion designed to increase markets for West Texas crude oil is planned by Standard Oil Co. of California.

Standard Oil Co. of Texas, a Socal subsidiary, will increase the capacity of its El Paso refinery from 36,000 bbl. daily to 61,000 bbl. daily. Another subsidiary, Pasotex Pipeline Co., will boost capacity of its Wink-to-El Paso crude line to 80,000 bbl. daily.

Pasotex recently completed a 68-mile section of 20-in. line on the 195-mile Wink to El Paso line. This section replaced two 8-in. parallel lines and boosted capacity from 45,000 to 55,000 bbl. daily.

An additional 75 miles of 20-in. line will be installed to replace a similar 8-in. system. This expansion will increase the capacity to 80,000 bbl. The line can be further expanded to a potential capacity of 220,000 bbl.

T. S. Petersen, Standard of California president, pointed out West Texas will have a direct link to Los Angeles when Southern Pacific Pipelines, Inc., completes its products line from Los Angeles to Phoenix this month. Southern Pacific recently completed the El Paso to Phoenix leg of the system.

"If there were an emergency, products or crude oil could be transported all the way from West Texas to Los Angeles with relatively simple changes in operation of Southern Pacific's lines," Petersen said.

No details of the refinery expansion were revealed.

Little Unions Aim Big

Independent groups representing 60,000 oil workers unite to meet O.C.A.W. threat; they hope to outgrow rival

BATON ROUGE.—A newly formed coalition of independent oil unions threatens to dwarf the A.F.L.-C.I.O. Oil, Chemical and Atomic Workers Union, now the biggest in the petroleum industry.

A group of 11 independent unions representing about 60,000 workers has merged into the new organization. It will be known as Independent Oil Unions. The group has set its sights on a potential membership of about 400,000 oil workers, or nearly twice the total number represented by O. C. A.W. in oil and other industries.

According to present plans, the new alliance will be formalized at a constitutional meeting to be called in about 45 days. In the meantime, the founders are keeping the welcome mat out for any other independent union.

Common aid . . . The new alliance, which has been in the talking stage for months, was motivated by a growing desire for mutual defense.

The common foe is not so much the oil companies which employ the independent unionists; it is O. A. (Jack) Knight, little president of the big O. C. A. W. Knight and his union have been trying systematically but without much success to move into plants occupied by independent unions.

Despite his 4 to 1 defeat at the Standard Oil Co. (Ind.) Whiting refinery *(The Oil and Gas Journal, January 23, page 47)*, Knight apparently plans to continue his "raiding" attempts.

Fight averted . . . It appeared for a time, Knight might make his next battleground at Humble Oil & Refining Co.'s big Baytown, Tex., plant. But evidently he changed his plans.

Baytown Employes Federation, an independent representing most of the Humble employes there, is one of the original participants in the new anti-Knight coalition. While the Baytown group was preparing its defense against O.C.A.W., another A.F.L.-C.I.O. union tried to move into the Humble refinery.

The Local Metal Trades Council asked the National Labor Relations Board to call an election to determine which union shall represent certain workers at the Baytown plant. The NLRB set a hearing on the question for January 31. But last month this hearing suddenly was postponed until February 14.

Postponement of the hearing followed a motion by Knight's O.C.A.W. to intervene in the NLRB election. But the motion later was withdrawn.

Word around Baytown was that the A.F.L.-C.I.O. top management had asked for the postponement. Speculation had it that Knight probably wanted his union to enter the contest for representation rights and that the A.F.L.-C.I.O. was trying to prevent two of its affiliates from challenging each other.

The Baytown Employes Federation is determined to keep either from moving in. "We've been an independent union for 19 years, and we figure on staying independent," remarked R. R. Dawson, president.

Freedom kept . . . Under the new coalition, each independent union can retain its autonomy.

One of the greatest selling points to individual members is that they will be spared the $1.35 monthly which O.C.A.W. workers pay to their national headquarters.

Temporary president of the coalition is Elmo Rogers, Ethyl Corp., Baton Rouge. A. E. Oliphint, Baytown, is vice president; Leo Martin, Independent Oil Workers of Oklahoma (Continental), secretary-treasurer; and Cecil Stanley, Central States Petroleum Union (Standard of Indiana), executive secretary.

Other oil unions represented were Independent Petroleum Workers of America, Stanolind Employes Bargaining Agency, Stanolind Employes Federation, Independent Industrial Workers Association, Associated Petroleum Employes, Independent Oil & Chemical Workers Union of Louisiana, and Humble Building Federation.

Other prospects . . . Oliphint says the Esso coalition, a group of independent unions representing employes of Standard Oil Co. (N. J.), has expressed interest in joining Independent Oil Unions.

The Jersey groups have a combined membership estimated at 15,000 to 20,000.

Two of the largest independents already are represented in the anti-Knight coalition. They are Central States Petroleum Union with about 7,500 members and the Independent Oil Workers at Whiting, representing about 5,500. Both bargain for Standard of Indiana employes.

Tall Timber-r-r-r...

Louisiana gasser boasts a 21-ft. christmas tree

FRANKLIN, La.—There's a tall tree in the Franklin field besides native timber. It's a 21-ft. christmas tree—reportedly the tallest in the world—installed at the 3 Godchaux gas well of Southern Natural Gas Co.

Two other trees of the same type are in use in the field. All are dual-ported valve assemblies made at the Houston plant of National Supply Co. Shown beside the tree above is L. A. J. Monroe, National's New Orleans district manager, whose 6-ft.-2 frame is dwarfed by the equipment.

Casing program on this well is 13⅜-in. and 9⅝-in. with a 7-in. liner. One string of tubing is set at 11,500 ft. with a production packer. The other is hung open ended at 9,500 ft. The well has flowing pressure of about 2,500 psi. with total depth of 15,000 ft.

A school official looks at the . . .

. . . Shortage of Engineers

By Dr. Charles C. Mason
Superintendent, Tulsa Public Schools

INDUSTRY is crying for more engineers, more scientists, and more mathematicians in the face of the greatest business and technological boom in the nation's history.

There are shortages in these fields, to be sure. But it must be emphasized that the dearth of trained and educated manpower is not peculiar to science and engineering. The demand for educated personnel is increasing in all areas—in medicine, business, and particularly in teaching, the mother of all professions.

As late as the winter of 1949-50, the United States Bureau of Labor Statistics predicted that there would soon be an oversupply of engineers. Colleges and universities advised a major number of students against preparing for a field so overcrowded that it offered slight chances for earning a livelihood.

Taking their cue from these institutions, public schools in turn advised many students against engineering careers.

Then came the Korean incident, nuclear-energy advances, and the application of electronics to automation. The demand for engineers and scientists jumped to unprecedented proportions. Indeed, any single one of these develments might have depleted the nation's technical manpower supply.

The sudden, almost "overnight" discovery on the part of industry that a shortage does exist indicates that industry, itself, was unable to predict or foresee this turn of events.

Now industry is telling the schools, "Give us more scientists."

Teacher situation worsens . . . Industry already is getting nearly all of those students who are now trained in science by the colleges.

In addition, they are (and have been for years) luring science teachers away from the public schools with much higher salaries than our schools can pay. The estimated beginning salary for college graduates entering engineering last year was $4,300 per year. The average for beginning teachers in cities was $1,000 less. For rural teachers, and indeed for all teachers in some of the lower-paying states, the gap is much wider.

The higher salary incentive has been so great that although young people continue to prepare for careers in science, fewer are preparing for careers in the teaching of science.

For example, in 1955 the 17 teacher-training institutions in Oklahoma granted only one standard certificate for the teaching of physics. Based on present information, there will not be a single new teacher in the state of Oklahoma certificated to teach physics this year.

The field of chemistry fared only a little better. In 1955 only five chemistry teachers were graduated in the state, and in 1956 there will be only seven new ones.

Suggested Solutions

In attempts to arrive at a solution to this problem, some have seen fit to draw a comparison of the number of scientists being trained in Russia with the number being trained in the United States. The inference is that Russian education might serve as a model for American education in order to meet the competition with Russia.

In the first place we cannot hope to compete numerically with Russia in preparing scientists because of the tremendous population of the Soviet orbit. In the second place, there is little freedom of choice on the part of students in Russia. They are selected, educated, and assigned to jobs at the will of the state for service to the state.

We in America adhere to the belief in the worth and dignity of the individual, and believe that with proper guidance and incentive we will produce an adequate supply of skilled technicians.

Another suggestion has been made that by drawing up lists of the fields in which trained specialists are needed, and then by intensive publicity and other appeals, the specific manpower can be produced.

Why this won't work . . . However, these approaches have a number of fallacies:

Modern society changes at a rapid pace. If we place too much emphasis on present needs for training in certain restricted subjects, there is danger that other equally important subjects will slip into a position of secondary importance to students. It has long been recognized that technicians need some broad training in those fields which prepare for a well-rounded citizenship as well as specialization.

Furthermore, it is difficult to gear schools to future needs because the schools have access to only limited information on which to base predictions of these chances.

As for the Russian method, any such manipulation of manpower rigidly adhering to a prescribed list of needs overlooks one fundamental fact: Americans are dedicated to the ideal of the state serving the individual and furthering his well-being.

Schools are already responding. For example, a report from Dr. Raymond Walters, president emeritus of the Uni-

This Is the Fourth . . .

Of five articles on the shortage of engineers and scientists.

Next week the Journal will present the views of the president of a society of professional engineers.

Three different viewpoints already have been outlined—those of an oil executive (Monroe E. Spaght, executive vice president of Shell Oil Co.); a personnel expert (A. H. Mitchell, director, Carter Oil Co.); and a research scientist (L. P. Whorton, director of production research, Atlantic Refining Co.).

versity of Cincinnati, shows that engineering freshmen are 13.2 per cent more numerous than last year. This is in comparison with a 7.7 per cent increase in freshmen enrollments in liberal arts.

Schools have dual role . . . The schools are doing their best to prepare more potential scientists for industry.

But industry must remember that the American public is quite generally dedicated to the idea of mass education—education for all of the children of all of the people for as long as reasonably possible.

Today a higher percentage of the total population is in the public schools and remains in school longer than ever before. More and more of these students enter college. But for an even higher percentage, graduation from high school ends their formal education. The schools have a definite responsibility for these people as well as for those who go to college.

Because of inadequate financing and personnel, public schools have been unable to do as much for individuals or small groups—such as potential scientists—as they would like.

Not more than half of the high school graduates who have fine potential in the fields of science and mathematics attend college. The reason in many cases is they cannot afford to.

Another reason why students fail to go to college is the lack of proper motivation and incentive.

What We Can Do

The solution to this problem will not be found through the efforts of the public schools alone. There must be a broad program along these lines:

. . . Industry must cease its practice of luring science and math teachers from the classrooms with more lucrative salaries than the schools can pay.

. . . Industry must provide scholarships or other incentives even on the high school level. This aid would go to boys and girls who, with proper guidance and counsel, could be encouraged to prepare for careers in teaching science and mathematics. Any future supply of people trained in science is dependent upon teachers who can give this training.

. . . All citizens must display a vital, active interest in the problems and needs of education.

. . . The public schools must be given the same attention and aid that business is now rendering the privately endowed institutions. Business and industry will ultimately defeat their own high purpose by encouraging only a segment of this country's leadership potential. The technical leadership which business seeks can be found in equal or greater numbers in schools dedicated to the service of all the people, the public high school.

. . . Money and encouragement should be provided the schools, whether devoted to secondary or higher education, to permit them to fully explore the possibilities of the more talented students. This aid can come either directly from business or as a result of business encouraging the state and local communities to take a more positive and aggressive attitude in providing for all students.

Support of education is even weaker than during the depression. In 1933-34, we spent 3.2 per cent of our national income on schools. Expenditures were only 2.8 per cent of the national income during 1953-54. Eighteen per cent of all federal, state, and local taxes went to public schools in 1935. In 1954, only 10 cents of every tax dollar was alloted to the schools.

. . . We need to strengthen lines of communication between business and industry and the public schools. Part of the present situation may be the result of industry's failure to recognize that close association with the high schools in guiding young science prospects is as important as its contact with colleges.

Industry must make its needs known to the schools so that they can be in a better position to help predict future changes and needs, and prevent a recurrence of the current shortage. Liaison can be improved by industry-sponsored seminars for teachers and by businessmen coming into the schools to teach short courses or special courses.

. . . We must upgrade all levels of public school education by providing a more highly trained personnel. That means paying better salaries, creating more personal incentive for those engaged in education. It means according greater respect to all individuals who carry such a heavy responsibility for the future growth and development of this republic.

New Deal in Alaska

● Colorado Oil & Gas asks development rights on 1¼-million-acre area

WASHINGTON.—A new deal is in the making for development of another large area of Alaska's potential oil lands.

A development agreement between Colorado Oil & Gas Corp. and the Yakutat Development Co. has been submitted to the Geological Survey and will probably go soon to Interior Secretary Douglas McKay.

The agreement covers 1,250,000 acres adjacent to the big block held by Phillips Petroleum Co. at Icy Bay. Yakutat Development represents applicants for 480 leases, mostly native Alaskans, whose holdings will be covered by an agreement.

The issue . . . All 480 applications were rejected by the land office in Anchorage.

It was ruled that together, they comprised more than 100,000 acres which is the maximum that can be held by a single interest in Alaska under the Mineral Leasing Act.

The applicants appealed to Washington. The bureau here affirmed the decision of the Anchorage office. Another appeal was made and the matter is pending before the secretary. The last appeal was made under a provision of the act permitting a greater acreage if it is an advantage for the Government and the territory to get development that would not be economic on a smaller scale.

The Phillips development contract was on a similar basis. The Colorado Oil & Gas contract is now being studied to determine if the conditions as to drilling, investment, etc., are satisfactory to the department.

Short in Alaska . . . Action on the lease appeals will be held up until a decision is reached on the development agreement. If the agreement is acceptable to McKay, it will be followed by an order remanding the leases to the Anchorage office with instructions to approve them, permitting the development to start.

Department officials, meanwhile, are studying the need to reinforce the Anchorage office if the agreement is approved, since the issuance of 480 leases will be a big job. At the moment, the office is short of personnel to do the work.

Phillips is the only Alaskan operator continuing drilling operations during the winter. Others have shut down but expect to resume work in the summer.

Middle East Squeeze Put on U.S. Firms

- **Britain's Eden reportedly asking Eisenhower to help control way Saudi Arabia spends its huge oil income**
- **Oil policy suddenly emerges as important key to any settlement of increasing tension in the Arab world**

Paul Swain

AMERICAN oil companies are caught in a diplomatic squeeze in the Middle East. Their position may become even more uncomfortable if the United States bows to British pressure over Saudi Arabia.

This is becoming more apparent in the wake of high-level diplomatic talks last week in Washington between Sir Anthony Eden and President Eisenhower. American oil firms and oil money were important elements of their discussions.

Top on the list of subjects taken up by the British prime minister and the American President was the troubled political situation in the Middle East. Both Eden and his foreign minister, Selwyn Lloyd, said conditions in that part of the world prompted their coming to the United States.

Their problem isn't simple. It's four headaches in one:

. . . **The Arab-Israeli conflict** which has been going on since the postwar formation of the independent state of Israel in what was once the British protectorate of Palestine. Israel is demanding that the United States furnish her arms to match those already sold to Egypt by the Communists. These demands are being backed in this country by the powerful Zionist groups.

. . . **The Arab-vs.-Arab struggle** for power in the Middle East is also a definite part of the unrest. The Egypt-Saudi Arabia-Syria bloc is aligned against the northern tier of nations, Iran, Iraq, Turkey, and Pakistan which entered the Bagdad defense pact with Britain. The recent Jordan riots protesting that country's entry into this group illustrate the violent differences.

. . . **Communist activity** in the Middle East is taking advantage of each chink in the Arab world's solidarity. It is exploiting the Israeli-Arab troubles to the hilt. When Czechoslovakia sold Egypt arms which Egyptians said they tried to get from the U. S. and couldn't, the Communists—like the Arab's camel—got their nose into the tent.

. . . **Basic differences in policy** on the part of Britain and the United States in the Middle East haven't exactly unified the western diplomatic efforts in this vital area either.

The U. S. has been more pro-Israel than the British. With its traditional anti-colonial philosophy, the U. S. moved counter to the British in a number of instances. It has suported the Bagdad pact, but has not joined it. On the economic front there is the very real rivalry between U. S. and British interests for Middle East oil.

As far as oil is concerned it is not only business with the British but government as well. Outright government ownership of British oil interests and the need for oil income from the Middle East to bolster Britain's sterling position in the world contrast with the private American oil companies in that area. Also the United States is not so dependent on Middle East oil as is Britain.

Oil royalties . . . Long before Eden and Lloyd landed in the United States last week, anyone who reads the daily papers know they meant to bring up one matter over which the United States has no direct control—the oil royalties collected by Saudi Arabia from Arabian American Oil Co.

Press reports from London for 2 weeks before the prime minister sailed mentioned repeatedly that Britain is worried about the income of more than $250 million a year which Saudi Arabia receives from the oil operation.

The British say flatly that the Saudis are using a good part of this oil income methodically to foment poltical discord in the Middle East. The British say the Saudis are using their oil money against their traditional enemies, the Hashemite family which rules both Iraq and Jordan. Both these nations are members of the Bagdad pact, which both Egypt and Saudi Arabia oppose.

The British say, therefore, that half the profits from an American oil operation are being used in such a way they give aid and comfort to the Communists in their not-so-subtle "divide and conquer" tactics in the Middle East. Nearly every press report from London predicted last week that the British prime minister would suggest to the United States Government that some means of control should be exercised over those oil royalties.

The Saudi Arabian Government last week flatly denied these British charges and levelled a few of its own against British colonialism in the Middle East. The Saudi embassy in Washington scored American newspapers, principally the New York Times, for printing what it called "biased and harmful propaganda" and charged:

Those responsible for the imminent danger underlying the trouble in the area could very easily be pinned down if we were to publish an available breakdown of the vast amounts of money spent by British for propaganda and other purposes in the Middle East."

Saudi sources were quick also to point to what they regard as a significant fact. Their country and one other area, the Neutral Zone between Saudi Arabia and Kuwait, are the only two oil producing regions in the Middle East in which there is no British interest.

Aramco, owned 30 per cent each by Standard Oil Co. (N. J.), Standard Oil Co. of California, and The Texas Co., and 10 per cent by Socony Mobil Oil Co., Inc., has said very little. The operating company and its parents are very much in the middle of the diplomatic muddle.

About all Aramco has done is to point out that neither it nor the U. S. Government has any control over what Saudi Arabia does with the income from its own oil.

The Buraimi dispute . . . Another important item admittedly on the agenda of the British diplomats has to do with oil, rather than diplomacy.

This is the dispute between the British and Saudi Arabia over a sandy wasteland in southern Arabia that was never important until there was a possibility it might be rich in oil.

The Buraimi Oasis is the pivotal point for any route from the interior of the Arabian peninsula or the Persian Gulf to the desert areas of Oman on the peninsula's southeastern coast. The oasis has about 15 sq. miles in area and an estimated population of about 10,000. It is the gateway from Saudi Arabia to the smaller shaikhdoms along the southwestern Arabian coast. It is claimed by the Saudis and also by the ruler of Abu Dhabi and the Sultan of Muscat. Both the latter are British protectorates and have been since the British moved into the coastal areas to protect Persian Gulf shipping from possible Arab marauders more than 100 years ago.

These conflicting claims to the Buraimi area have existed for years, but have never been particularly important

until oil development began in the Middle East. The claims finally were submitted to arbitration at Nice, France, in January 1955. Members of the panel included Dr. Charles DeVisscher, Belgian jurist; Dr. Ernesto Dihigo, foreign minister of Cuba; Dr. Mahmud Hasan, Pakistan university professor; Sir Reader Bullard, former British minister in Saudi Arabia; and Shaikh Yusuf Yasin, deputy foreign minister of the Saudi Government.

The British representative charged the Saudis with systematic bribery of the nomadic tribes of the Buraimi area to claim allegiance to the Saudi Government. He quit the tribunal in protest. In September 1955 the negotiations broke down completely after the British also quit the panel. The following month, British-led forces from Abu Dhabi, the Sultanate of Muscat, and the Trucial shaikhdoms seized the Buraimi oasis and ejected a small force of Saudi police stationed there. The British-officered forces have held the oasis since.

The Saudis protested the "aggression" and have demanded that arbitration be resumed and the forces withdrawn. The British have refused and the Saudis say they will present the problem to the United Nations.

In December 1955, Muscat troops under British command moved southward to Nazwa, the capital of the Imamate of Oman, and seized control. The elected Imam of Oman fled to the mountains. The British claim the Imam is a subject of the Sultan on Muscat, but he and the Saudis claim his area is an independent region.

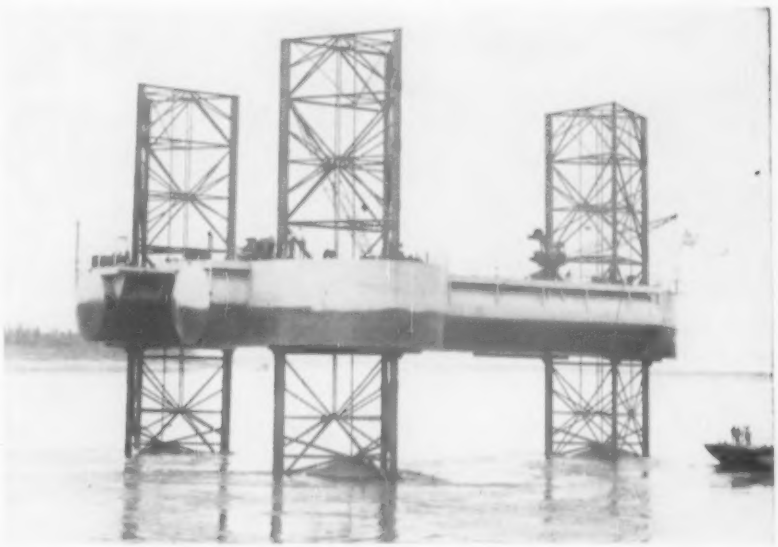
Oil mirage? . . . Since the dispute over the Buraimi Oasis flared and the Muscat troops moved into Oman, the oasis area has been described repeatedly as "oil rich."

Actually, no oil has been discovered within 100 miles of the oasis. Exploration concessions, however, are at stake. Affiliates of Iraq Petroleum Co., controlled by British interests, have exploratory concessions in all the small shaikhdoms in southeastern Arabia. I.P.C. crews are now drilling a well at Cezira, some 200 miles west of Buraimi. An I.P.C. well which had oil shows, but was abandoned as uncommercial is located at Murban, about 100 miles west of Buraimi.

An I.P.C. affiliate is preparing to spud in a test in Oman at Jebel Fahud, 175 miles southeast of Buraimi. It was apparently because of this well that the troops moved in in December to oust the Imam of Oman. The concession to the area was granted to I.P.C. by the Sultan of Muscat.

The Saudi Arabian Government claims all these sections are "agressions" of the British and are an invasion of her soverignty in the Arabian peninsula.

Jersey Standard and Socony Mobil find themselves in the embarrassing position of having interests on both sides of the British-Saudi Arabian dispute. The two companies each own 30 per cent of Aramco, the only company operating in Saudi Arabia. They are also minority stockholders in Iraq Petroleum. Between them, the two companies own 23.75 per cent of I.P.C.



Work clothes added after . . .

. . . Tripod Rig Gets Feet Wet

GALVESTON, Tex. — Zapata Off-Shore Co.'s new three-legged mobile drilling platform has completed a 730-mile voyage down the Mississippi River from Vicksburg, Miss., and along the Gulf Coast to Galveston for outfitting.

Installation of a heavy-duty rig, crew quarters, and other units will be completed about mid-February. The huge platform, after a public commissioning ceremony here, will then head out on its first job—a wildcat location in 45 ft. of water off Port Aransas for Standard Oil Co. of Texas.

The $2,000,000 structure, the first of its type, weighs 4,000 tons and will operate in open gulf waters up to 80 ft. deep. The platform was designed by R. G. LeTourneau, Inc., and built at the LeTourneau yards at Vicksburg.

Tests of the platform were conducted in November both on land and in 33 ft. of water on the Mississippi near Vicksburg. The platform was raised with an 8,000,000 lb. load in both the land and water tests.

Original plans were to outfit the platform at a site near Vicksburg, but Zapata officials decided later to have this done at the Galveston docks.

George Bush, Zapata vice president, said the long towing job to the Gulf port city went smoothly. The platform tows very well and faster than most, he said.

Momentary difficulty was encountered at some of the lower Mississippi River bridges. In some instances the spuds had to be lowered before the platform could slide under the bridges.

Builders of the big structure claim it is stormproof and costs no more than permanent-type platforms. Its normal drilling position is 40 ft. above water.

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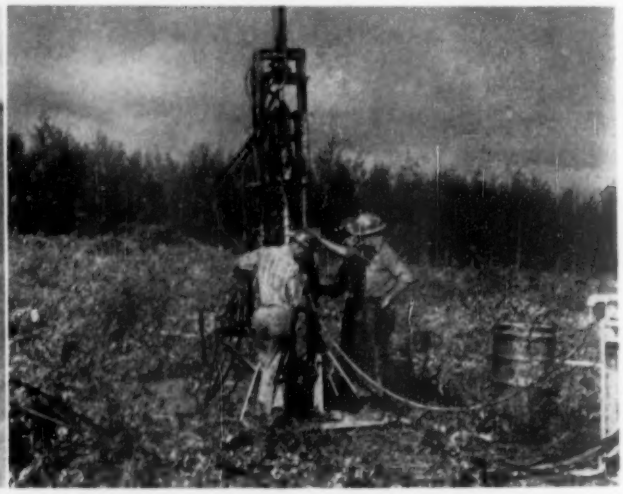
Shell takes to the air in Canada's muskeg country . . . *flying all equipment to locations.*



Part of a shot-hole rig takes a ride . . . *then is quickly set up in the battle of . . .*

Licking the Muskeg with Helicopters

WHEN the thaws come this spring, Shell Oil Co. will have a proven way to move its oil explorers and their equipment over northern Canada's oozy muskeg country.

There's no problem now. The muskeg is frozen and wheeled vehicles can move easily. But when warmer weather melts the frost, not a wheel can turn in the morass. Then Shell exploration crews will take to muskeg-hopping by helicopter.

Muskeg has been one of the great handicaps of summertime oil exploration in northern Canada. The country is a wilderness, thickly wooded and densely matted with moss and underbrush hugging marshy ground. This means a soft, spongy footing, impassable expect when frozen.

Experiment works . . . Shell turned to the helicopter last summer.

It was an experiment in an attempt to carry out full-scale summer seismic work in northern Alberta and the Northwest Territories where activity usually shuts down in the summer.

Shell officials are pleased with the accomplishments. They admit the air operation is not the final solution to the problem. But they say it is an important development toward search for oil in that lonesome country.

Fast air team . . . Shell contracted with General Geophysical Co. to attempt for the first time in Canada the airborne seismic job.

A conventional seismic party and two helicopters with their crews are used. In addition, 30 brush-cutters, mainly comprised of local Indians, plus cooks and helpers make up the complement.

Each brush-cutting crew includes a foreman and four cutters armed with axes, machetes, and power saws. They work ahead of the seismic men, hacking out heliports and cutting lines for the surveyors. They travel overland mainly on foot. But when foot travel becomes impossible, the cutters are whisked to the next location by heli-

copter or move on streams by canoes.

These crews cut a 300-by-900-ft. heliport every third of a mile. Twenty-five men cut an average of seven or eight heliports a day.

These heliports are linked by the surveyor's line. In clearing for the line, the head chainman indicates the direction using a 200-ft. steel chain and large poles. Four cutters work behind him hacking out the underbrush. The surveyor measures the turns and sets out flags every 150 ft. Another surveyor also follows the drillers. When a shot-point is inaccessible, he plots the change of location.

Field operations . . . The seismic crews move in after the heliports and lines are cleared.

A shot-hole rig was specially designed by Sewell Wet Auger Drill Co. of Tulsa for the operation. It breaks down into four units. Each weighs less than 900 lb. and can be lifted from one location to another.

Each unit is carried on sling-load by the helicopter flying about 200 ft. above ground. A crew member who has walked ahead to the clearing guides each load to the ground.

In this manner, the drilling mast, motor, hydraulic cooling system, drill-stem, drilling water, and the men are moved quickly to location. Each load requires about 4 minutes.

A second helicopter brings in the recording unit. It is an aluminum unit weighing less than 800 lb. complete with instruments. It is hauled in a single sling-load. Crew members lay cables out ahead so no time is lost by the recorder and shooter waiting on lines.

Under ideal conditions the crew can shoot seven holes in 2½ hours. This is faster than average crews can work along a prairie road using conventional methods.

Big problems . . . Chief headaches of the airborne seismic work are caused by flying conditions.

The big S-55 helicopters can't operate in gusty winds or when visibility is limited by rain or mist.

On the ground, the light drill takes longer to complete a hole than the conventional heavier equipment. Foot travel often is difficult over muskeg marshes. And the men are plagued by the persistent northern mosquitoes.

Air transportation overcomes the problem of supply. Shell uses a DC3 to fly cargo into Fort Simpson on weekly flights. The supplies then were barged to a field camp.

The entire operation is tied together by a radio inter-communication system linking all units.

watching WASHINGTON

. . . with Bertram F. Linz

Does oil mix with fur and feathers?

THE birds and the buffalo may turn out to be one of the most entertaining, if not the most important, political issues of the 1956 campaigns.

Maybe with that in mind, Congress got into the hassle over oil and gas leasing of the wildlife refuges.

A House committee got a fill-in from Interior officials and conservationists who tangled last month when the department resumed leasing after a 28-month wait while the regulations were rewritten.

There are 264 refuges scattered about over the country. All but 12 were reopened to leasing when the new regulations were signed. Conservationists argue that a provision of law controlling uranium leasing applies also to oil. Under that provision leases could be issued only with the approval of the President.

The department contends that the uranium restriction has nothing to do with the matter. Refuge leasing was provided for by Congress in the Mineral Leasing Act and that law has not been restricted.

About 90 leases have been granted in the past 34 years. More than two-thirds of them appear to have been issued while leasing was "suspended." But the department explained those leases were for "protecting the interests of the United States," presumably from drainage. But one of them led to the first development in South Central Nevada, raising a question as to what was "protected."

Hardy Detroit case opens new round . . .

THE Standard Oil Co. (Ind.) Detroit case is back in the news, older but no less vigorous than when it first bloomed almost a generation ago.

There will be news about it for some time to come. Standard last month asked the Chicago Circuit Court of Appeals to dismiss the Federal Trade Commission's complaint, starting it on a second trip to the Supreme Court.

The Detroit case started in 1940 when the FTC charged the company with selling gasoline to four dealers for less than it charged other customers in the same area. Six years later it issued a decision that the Robinson-Patman Act had been violated. Standard was told to stop the discrimination.

Standard took the case to court. In 1951 the Supreme Court handed down its opinion. Cutting of prices to individual customers in good faith to meet the lower prices of a competitor is legal, it said.

The case went back to the FTC for revision of its order in line with that opinion. In 1953 the commission issued a new order, holding the company had failed to show its lower prices were granted in good faith. After fighting vainly for reconsideration by the FTC, Standard went back to court.

Atomic heat—key to synthetic fuels . . .

THE Interior Department has a new idea for making synthetic liquid fuels from coal.

It's studying the possibilities of making gasoline from coal gas by using nuclear heat.

The idea was developed in discussions between the Bureau of Mines and the Atomic Energy Commission. Experiments will be carried out at the bureau at Morgantown, W. Va. Two units will be built for tests, using electricity instead of nuclear heat.

The AEC will make engineering studies of the factors that must be considered in the nuclear phase of the problem. If the Morgantown tests and the engineering studies work out, the two will be combined for further work.

If nuclear heat could be applied to the gasification of coal, it would solve the basic problems of making both synthetic fuels and pipeline gas.

Gas Field Rules Changed

● Interconnection of common buyers' gathering systems required in rule applying to Blue Basin field of Texas

AUSTIN.—The Texas Railroad Commission has taken a long-awaited step in the drive to achieve true ratable gas take in Texas.

Rules for its latest "guinea pig" field include the requirement for interconnection of the gathering systems of common purchasers. It's designed to eliminate over and underproduction from wells in the same field.

The newest trial balloon launched by the commission in experimenting with gas regulations is in little Blue Basin field, Wharton County, on the Gulf Coast.

How rule works . . . The pipeline gas buyer in Blue Basin now must connect his system with another pipeline's or with unconnected wells. The rule applies if wells from which he normally takes gas have overproduction that can't be made up during the second succeeding balancing period.

He must take from underproduced wells in the field that volume of gas he needs over the allowable of overproduced wells to meet his market demand.

The order, on the other hand, is binding on buyers connected to wells with underproduction that can't be made up during the second succeeding balancing period. It's binding also on unconnected producers with such underproduction.

These must permit a buyer connected to overproduced wells to connect to any or all the underproduced wells and buy gas from them until all underproduction is eliminated.

Independent producers have had little time to study Blue Basin field order and comment officially. But initial producer reaction appears to be that the commission now is on the verge of attaining true ratable gas take.

Other field rules . . . The new rules for Blue Basin are identical to those fixed for Henze field in Dewitt County last summer *(The Oil and Gas Journal, September 5, 1955, page 68)* except that the interconnection rule is stronger and more meaningful.

At Henze, where the commission made its first try in the current drive for more efficient and equitable gas proration, there was only one pipeline.

At Blue Basin, as at Henze, the field allowable will be distributed to each well on the basis of percentage factors established by the commission. These

factors, based on the field-allocation formula, will entitle each well to a certain per cent of total field production.

Producer nominations as a basis for setting allowables were discarded. Purchaser forecasts of demand will be required but will be used only as an aid to the producer in estimating his approximate monthly allowable.

Earlier at Alco-Mag field in Harris County the Railroad Commission set up a proration system under which it tries to determine market demand. That demand is divided equally among all wells even though some may not have a pipeline connection.

Texas Allowable Hits Peak

AUSTIN.—Texas' daily oil-production allowable has reached the highest point in history.

The new record of 3,404,180 bbl. per day was set during the week ended January 28.

The previous record was set in November 1952. The average calendar-day allowable for the week ending November 22, 1952, was 3,380,720 bbl. The following week it rose to 3,387,245 bbl. per day.

The high 1952 levels were reached during a month when 23 production days were permitted by the Texas Railroad Commission. The January record is even more impressive in view of the fact it was set with a 17-day producing schedule.

The commission reports that oil and gas drilling activity also is running above last year's pace.

Escape Clause Out

FPC approval required to cut off deliveries of gas

WASHINGTON.—The Federal Power Commission buried escape clauses last week.

Previously the FPC ruled the clauses are illegal under the Supreme Court decision in the Phillips case. Last week they reaffirmed this view in backing up an examiner's decision that 14 producers failed to show cause why they should not be required to get permission before halting deliveries to Texas Illinois Natural Gas Pipeline Co.

The producers argued that the escape clauses in contracts made before the Phillips decision permitted them to discontinue deliveries when the FPC began regulation of producers.

The FPC, however, held that they are subject to the Natural Gas Act and the Phillips decision, regardless of any effort they made to protect themselves against that contingency.

Firms Plan Merger

Stock transfer deal may unite Tekoil, St. Anne's

DALLAS.—Tekoil Corp. of Robinson, Ill., soon may absorb St. Anne's Oil Production Co., Midland, Tex., in a stock transfer deal.

Directors of both firms have approved the merger. Tekoil executives are now preparing to submit the plan to stockholders. Under the proposal each St. Anne's stockholder will receive 56/100 share of Tekoil for each St. Anne share he holds.

Tekoil will take over St. Anne's operating interests in 82 oil and gas wells in West Texas, New Mexico, and Kansas with present gross production of more than 500 bbl. daily. It also will acquire 8,000 acres in undeveloped leases.

W. H. Davison, president of Tekoil, said the St. Anne's deal will add 1,200,000 bbl. to Tekoil's proved primary reserves and roughly 3,000,000 bbl. to proved secondary reserves.

Tekoil, which has specialized in water-flood operations, already is planning to launch floods in the Queens sand production underlying St. Anne's properties in Malicky and Lenn-Apco fields in Pecos County, West Texas.

The merger represents Tekoil's first venture into West Texas, New Mexico, and Kansas. The company is active currently in Oklahoma, Illinois, Indiana, Kentucky, and East and South Texas.

Gus Going to Sea

Big platform will be used to drill 63 miles offshore

CORPUS CHRISTI.—Barring a severe storm in the Gulf of Mexico, the mobile drilling platform "Mr. Gus" early this week will spud a well 63 miles from shore—farther from land than any test yet drilled.

Late last week the $3,500,000 vessel started a 200-mile voyage to the new location. It is being pulled by two 900-hp. tugs from its last drilling assignment just east of Corpus Christi to Block A-104, High Island area, 63 miles off Galveston. A brisk headwind reduced the vessel's cruising speed to about 2 m.p.h., less than two-thirds the normal rate.

C. G. Glasscock Drilling Co., owner and operator of the platform, hopes to spud the new test Monday, within 24 hours after the vessel reaches location. The well will be the first drilled on a 103,680-acre block or leases held by Shell Oil Co. and Continental Oil Co.

Four wells have been drilled from the platform since it first went to work last spring. Its latest was a 13,000-ft. dry hole for Humble Oil & Refining Co. about 4 miles east of Mustang Island.

Glasscock reversed earlier plans to put extensions on the platform's piling before floating it into the 93-ft. water east of Galveston. The vessel was designed to operate in water 100 ft. deep.

Crude Deliveries to Rise

EDMONTON.—Crude throughput of the Interprovincial pipeline will be stepped up to full capacity of 214,000 bbl. daily this year with expansion of facilities and markets for western Canada oil.

T. S. Johnson, Toronto, president of Interprovincial Pipe Line Co., announced that deliveries to Michigan would start this month. The line handled 190,000 bbl. daily during December, more than double the 1955 average of 90,000 bbl.

Interprovincial will spend $9,000,000 to extend line facilities in Manitoba and Minnesota. A 129-mile line is planned from Cromer, Man., to link with oil fields in southern Saskatchewan and Manitoba.

New Pump Station Planned

VANCOUVER, B. C.—A new pump station will be added to the 20-in. spur off the Trans Mountain crude line at Laurel, Wash., to permit handling of full main-line deliveries as they are increased. Cost will be $800,000.

Movement of Canadian crude through the Trans Mountain line from Edmonton has reached 110,000 bbl. per day. Throughput is about evenly divided between British Columbia and Washington refineries.

New Pembina Tests

Cal-Standard stakes two Cynthia block wildcats

EDMONTON. — California Standard Co. has staked two more exploratory wells on its Cynthia block of Alberta's Greater Pembina area.

The new tests will be the fifth and sixth for the 92,160-acre spread for which the company paid $10,500,002.

The company reports one of its first four wildcats is a producer from the Cardium sand, two are being tested and the fourth is drilling *(The Oil and Gas Journal, January 30, 1956, page 119)*. Completion details, however, still have not been released.

The new wildcats, like previous tests, are located in the eastern part of the reservation. They will be known as the NE Cynthia 12-6, staked 5 miles west of the NE 4-12, indicated Cardium oil success, and the NE 12-30, staked 5 miles west of the NE 4-24, the reported successful oil completion.

Cal-Standard's NE 4-24 was taken to total depth of 7,100 ft. with production reported from the Cardium at about 5,800 ft. The company's block lies immediately west of a tract for which Texaco Development paid $13,000,000 in 1954 and later drilled eight successful Cardium wells.

Midway Field Unit Approved

EL DORADO, Ark.—The Arkansas Oil and Gas Commission has approved application from Sunray Mid-Continent Oil Co. to unitize Midway field near Lewisville in Lafayette County.

Sunray Mid-Continent is a pioneer producer in Midway and the largest single operator there. Company authorities testified that Midway's primary recoverable oil in 1942 as 28 million barrels. But with pressure maintenance more than 34 million barrels had been produced by the first of this year. Ultimate recovery of 65 million barrels would be boosted by 5 million barrels by unitization operations.

The field now is operated on a lease-by-lease basis. Because of the water pressure maintenance system used, Sunray Mid-Continent officials claimed there is a possibility of future inequities in returns from various wells.

Industry BRIEFS

EDMONTON.—The Socony Mobil group, which discovered the huge Pembina field July 1, 1953, will drill about 180 wells in the field this year. They will be drilled on 80-acre spacing. This program will bring the group's total wells in Pembina to 330, and the number eventually is expected to reach 600.

Socony has 50 per cent interest in the acreage, Seaboard Oil Co. 16⅔, Honolulu Oil Corp. 16⅔, and Merrill Petroleums, Ltd., 16⅔. Pembina had 784 wells at the beginning of 1956. This total is expected to grow by 800 during the year *(The Oil and Gas Journal, January 30, page 337)*.

TULSA.—The seventh annual Corrosion Short Course for Pipeliners will be held in Tulsa February 15 to 17. The course is sponsored by the Tulsa section of National Association of Corrosion Engineers.

SALT LAKE CITY.—A top bonus of $207 an acre was offered for 228.46 acres on the known geologic structure of Clear Creek field at a sale conducted by the Bureau of Land Management last week. The high bid was made by Paul T. Walton, Salt Lake City. Two other parcels brought only $10.10 and $1.75 an acre.

HOUSTON. — Continental Oil Co. last week added one-half cent per gallon to the tankwagon price of gasoline to dealers and service-station operators in Texas. The increase is effective for both premium and regular gasolines.

It was Conoco's first general price boost to Texas dealers in about 2 years. The company posted a similar increase in Oklahoma, New Mexico; and parts of the Rocky Mountain region several months ago. Increased manufacturing costs and the need for added improvement in gasoline quality were cited as the reason for the increase.

DENVER.—Organization of Lincoln Oil, Gas & Refining Co. was announced here last week by W. E. Morgan, executive vice president of the firm.

He said the company has purchased one-half interest in Seminole Asphalt Refinery, Ltd., St. Marks, Fla., which has a crude capacity of 2,500 bbl. daily. The firm also has purchased Cyclone Drilling Co., Tulsa, which has two rigs, and is moving its offices to Denver. In addition, it has acquired 500 bbl. a day oil production in Oklahoma, Kentucky, and Illinois.

Tankage Now Automatic

Esso pioneering new refinery system which saves cash by centralized control of gaging, blending, and storage

COLLEGE STATION, Tex. — Esso Research & Engineering Co. is pioneering in centralized control of gaging, blending, and storage with a system that promises dollars and cents benefits to refiners.

The company is applying automatic remote tank gaging to a centralized control and inventory-logging system. It's being installed at one of the big eastern refineries of Esso Standard Oil Co., reportedly the 170,500-bbl. daily Bayway plant.

Here are the immediate results expected by Esso:

. . . **Increased storage capacity** of at least 4.6 per cent.

. . . **Greater accuracy of control.**

. . . **More accurate gaging** and accounting.

. . . **Faster calculation of inventory** data, plus speedier transmission of records to accounting and operational divisions.

. . . **Reduction of manpower.**

. . . **Elimination of hazards of** hand gaging.

And that isn't all. The system removes another obstacle holding up complete automation of this phase of refinery operations. The next step: application of computer controls used on process units to blending systems with automatic control of tank levels and flows.

Central control and blending . . . The operation was outlined by William Knesby of Esso Research & Engineering, Linden, N. J., in a paper presented at Texas A. & M.'s symposium on instrumentation for the process industries.

Esso will direct all major oil movement and storage operations from a central control point housing a graphic console of the farm and the data-logging equipment. The console represents as nearly as possible the physical layout of the farm, showing all tanks, pumps, major lines, control valves, and manifolding.

At the control point, analog data on tank levels are received from automatic tank gages. Figures are converted to digital data and logged by automatic typewriter and punch-card equipment. The logging system will gather and record inventory figures either periodically or on a spot basis.

Flow control for blending purposes in two main streams is also to be remote controlled. This allows specific quantities of secondary components to be injected in proportion to flow of the main streams.

In-tank blending will be done by using present tank levels for blending specific components in selected tanks. When the remote digital level indicator reaches the predetermined set point, the control valve on the tank will be closed automatically.

The automatic logger will record these operations as to time, stock classification, and tank level. Log sheets, punched tape, and card records will speed the information to accounting and operational divisions. They will be able to keep abreast of operations and take any corrective steps needed without costly time lags.

The centralized system is expected to eliminate spillovers and errors common to scattered, manually controlled facilities.

System will pay out . . . Knesby says a complete system in a new tank field layout would cost no more than 5 per cent of the total installation cost. This is about the same as for instruments in normal refinery process units.

Cost of installing the automatic remote gaging is just over 1½ per cent of total investment in tank field installations. But this is justified by the increase in usable storage resulting from more accurate readings.

Normal utilization of tanks is now about 85 per cent of capacity. Esso expects to raise this to 90 per cent or more with improved gaging and control. That would mean an net addition of 50,000 bbl. per million barrels of storage capacity which would cost $50,000 to build.

Montreal Refinery Installs Atom Sorter

MONTREAL.—The first atom sorter to be used in a Canadian refinery is now at work at British American Oil Co.'s Montreal East plant. Engineers are using the $60,000 machine to analyze refinery streams in their effort to produce better petroleum products.

The mass spectrometer is a complex electronic and high-vacuum device. It can sort out various isotopes in oil refinery streams containing up to 20 components and photograph them by amplification in a recording unit.

The analysis can be done in less than 30 minutes. Computation of results, however, may take a day. In the photograph above, a B-A chemist is removing the filmed record for computation.

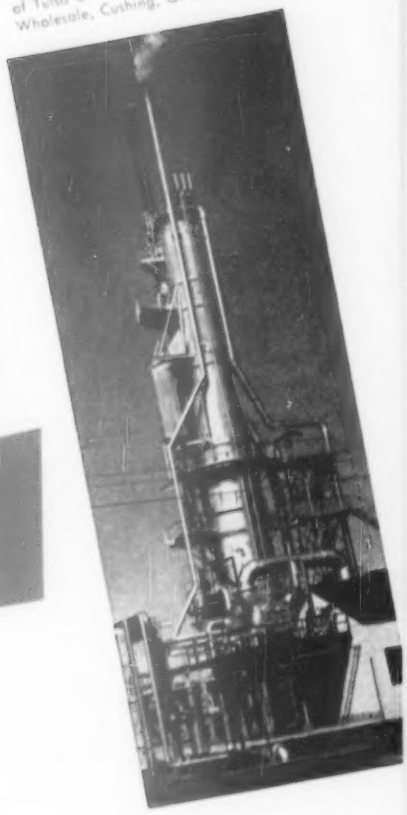
B-A's mass spectrometer required the interconnecting of 20 separate chassis to form the basic electronic controls, 113 vacuum tubes for its circuitry, and, besides normal laboratory facilities, specialized equipment and extensive computation machines for interpreting the instrument findings.

The first commercial mass spectrometer was devised in 1942 and purchased by a United States refining company. Since then more than 50 instruments have been put to work in the oil industry.

Reactor-regenerator for UOP Catalytic Cracking Unit furnished through Refining Engineering Co. of Tulsa for Kanotex Refining Company, Arkansas City, Kansas.

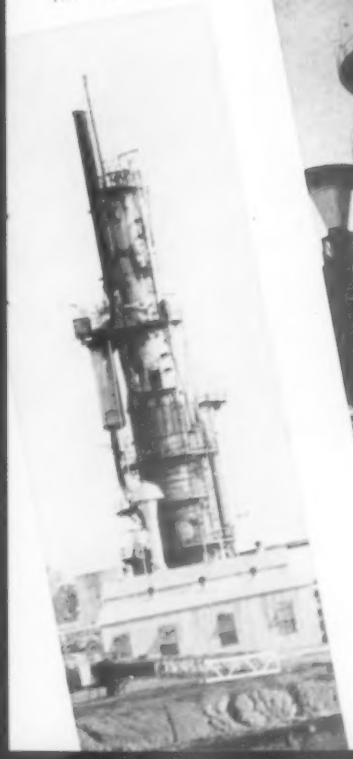
Reactor-regenerator and two cat hoppers built for Rock Island Refining Company at Zionsville, Ind.

UOP reactor-regenerator built for the Refining Engineering Company of Tulsa at Midland Cooperative Wholesale, Cushing, Oklahoma.



REFINERY BEAUTY

UOP reactor-regenerator unit furnished for the Ben Franklin Refining Co., Ardmore, Oklahoma.



Regenerator, part of a Model IV Catalytic Cracking Unit, furnished through Fluor Corporation Ltd. for Standard Oil Company of California, El Segundo, California.

Where there are refining operations there are sure to be welded steel plate structures built by CB&I. Pressure vessels, cat crackers, Hortonspheres®, Hortonspheroids®, Horton® Floating Roofs and others . . . refinery structures built to exacting specifications by skilled craftsmen.

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Gas Bill Voting Looms

● **Preliminary debate over, measure now faces first test on amendments; actual showdown will come by midweek**

WASHINGTON.—This is the week of decision for the Harris-Fulbright gas bill.

With 3 weeks of debate under its belt, the Senate today gets down to the job of actual voting. Fate of the bill to relieve independent gas producers from Federal Power Commission price control may be settled by midweek.

The first votes will be on various amendments to the Fulbright bill offered by opponents of the measure.

Two decisive votes will follow. The first will be on a motion to substitute the Harris bill, passed by the House last year, for the Fulbright bill.

That vote will determine whether the measure, if passed by the Senate, will go direct to President Eisenhower for approval. If the motion fails, any bill approved by the Senate will have to go back to the House. Once in the hands of the House again, it probably would be buried for the rest of the session.

Tempo hotter . . . Pace of the debate was speeded up last week.

For several days the Senate met an hour earlier than its usual noon time. Today it meets 2 hours earlier—10 a.m. By unanimous agreement, debate on each amendment or motion will be limited to 1 hour. Debate on final passage of the bill will be limited to 3 hours.

An important provision of the agreement is a bar on amendments not germane to the bill. That will prevent efforts to sabotage it by writing in amendments that have been suggested, such as a proposal to divorce oil transportation from other activities.

Confidence . . . As the time for voting drew near, supporters of the bill showed increasing confidence in their ability to pass it.

Opponents admitted that their only chance of killing the measure would come this week. Sen. Paul Douglas of Illinois, leading the fight against the bill, conceded that if it reached the White House it would be signed by the President.

Using the gas bill as a springboard for an attack on the oil industry, Sen. Thomas C. Hennings of Missouri called on Congress last week to investigate the "giant oil companies" to see whether the Corrupt Practices Act (federal election laws) "protect the people against a powerful price fixing monopoly working in politics through both major parties."

Hennings is sponsor of a bill to amend the law to provide for supervision of campaign funds. He made it clear he was not offering it as an amendment to the bill. But he added the legislation was evidence of the political activities of the oil industry.

Money power . . . A probe "long overdue" will be pressed later in the session, Hennings announced.

"The concentrated power of the great oil companies, wielded today to influence the decisions of national Government by contributions to both parties in many parts of the United States is a menace to the proper functioning of free government," the senator asserted.

Hennings noted that the gas bill has the support of powerful Democratic leaders in the oil-producing states. But, he hastened to add, he did not impugn the sincerity, integrity or honor of men working for the bill.

"I merely wish to reinforce and reiterate my conviction that the power of the federal Government to regulate one gigantic industry which has piled up through many years long records of monopolistic conspiracies against the public welfare is now being tested here in the Senate," Hennings explained.

Crude Imports Set New Record

TOTAL imports of crude and products in November reached the highest level since the all-time record in February 1954, according to reports by the Census Bureau of the Department of Commerce.

Other highlights for the month were:

. . . Crude imports set a new record with a daily average of 879,000 bbl., topping the old crude record of 844,700 bbl. daily set last August.

. . . Imports from Canada reached a new all-time high with an average of 80,000 bbl. daily. Canada became the third ranking supplier of crude moving into the United States, following Venezuela and Kuwait.

. . . Total exports dropped to the lowest point since September 1954.

Imports of both crude and products averaged 1,390,000 bbl. daily for November, an increase of 191,000 bbl. daily or 15.9 per cent over the total reported for September. However, part of the big increase can be credited to the abnormally small seasonal gain in October. The October average was up less than 1.0 per cent from the average for the four preceding months.

Residual imports averaged 446,500 bbl. daily in November for a gain of 6.1 per cent over November 1954 but failed to match records established last winter. Resid imports exceeded 500,000 bbl. daily every month last winter from December through March. The average for the period was about 548,000 bbl. daily.

Total exports averaged 263,700 bbl. daily compared with 327,500 bbl. daily in October and with 333,000 bbl. daily a year earlier. Significant decreases were reported for gasoline, distillate, residual, and miscellaneous products. Exports of kerosine and lube oils were very near October levels.

IMPORTS INTO CONTINENTAL U. S.

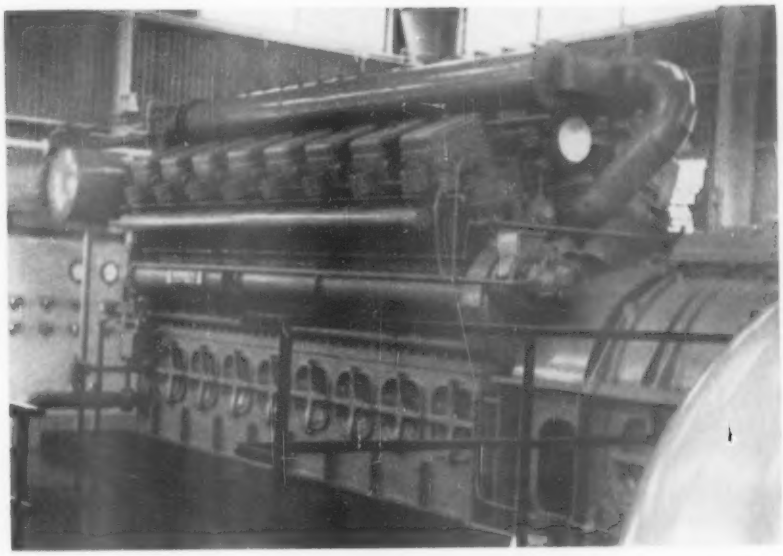
(Thousands of barrels)

	Nov. 1955	Oct. 1955	Nov. 1954
Crude—			
Mexico	270	244	381
Colombia	827	746	819
Venezuela	12,230	12,989	11,258
Peru			110
Ecuador	72	72	
Trinidad			102
Kuwait	4,651	4,605	3,643
Saudi Arabia	2,280	2,264	2,328
Neutral Zone	444	165	217
Iraq	1,084	821	
Iran	571	402	
Qatar	465	175	217
Canada	2,399	1,744	559
Far East	1,078	996	475
Total crude	26,371	25,223	20,109
Daily average	879	814	670
Products—			
Residual fuel	13,395	10,521	12,622
Other products	1,937	1,405	1,524
Total products	15,332	11,926	14,146
Daily average	511	385	472
Total all oils	41,703	37,149	34,255
Daily average	1,390	1,199	1,142

EXPORTS*

	Nov. 1955	Oct. 1955	Nov. 1954
Crude	872	871	1,047
Gasoline	2,050	2,663	2,175
Kerosine	93	93	427
Distillate fuel	1,427	2,279	2,682
Residual fuel	1,456	1,913	1,842
Lube oils	1,030	1,071	1,043
Other products	984	1,263	774
Total all oils	7,912	10,153	9,990
Daily average	264	328	333

*Excludes shipments to territories.



Transco Starts Up New-Type Compressor

HOUSTON. — Transcontinental Gas Pipe Line Corp. last week started experimental operation of a new type of compressor station near Houston.

Transco believes the station is the first to use a large-capacity gas engine to drive a centrifugal compressor. The Nordberg four-cycle engine is rated at 3,000 hp. and drives the compressor through a step-up gear. The compressor, equipped with automatic controls, was made by De Laval Steam Turbine Co.

Constructed by Fish Engineering Corp., the station is on Transcontinental's 30-in. main line about 20 miles northwest of Houston. It is about halfway between booster stations at El Campo, Tex., and Sour Lake, Tex.

Texas Butane Caverns Planned

HOUSTON.—A second pipeline and underground storage system will be built on the Gulf Coast to handle butane going into the manufacture of butadiene.

Texas Butadiene & Chemical Corp. soon will start drilling salt-dome storage wells in Barbers Hill field of Chambers County. Both butane and isobutane will be stored there, then piped about 14 miles to the company's avgas and butadiene plant now under construction.

Plans for the storage caverns have been approved by the Texas Railroad Commission.

The butane-handling facilities are similar to those announced 2 weeks earlier by Tennessee Gas Transmission Co. T.G.T. plans to build a 200-mile pipeline to transport butane and other liquefied gases from Banquette, Tex., to the Petro-Tex Chemical Corp. butadiene plant here. The pipeline company also will store reserve butane in the Chambers County salt dome *(The Oil and Gas Journal, January 16, page 83).*

Pipeline network . . . Texas Butadiene & Chemical Corp. will start with a "limited number" of storage wells, each with a minimum capacity of 100,000 to 200,000 bbl.

Construction will start soon on a total of five pipelines serving its butadiene plant. Two 6-in. lines will be laid between the storage area and the plant to transport butane and isobutane. In addition, the company will lay one 6-in. and two 4-in. lines to move avgas and other products from the plant to the Houston Ship Channel, a distance of about 11 miles.

Source of raw materials going into the new butadiene plant was not revealed. During the early stages of operation, butane will be delivered by tank car, tank truck, and perhaps by barge. Later, butane and isobutane may be piped from one or more producing areas.

Double output . . . Texas Butadiene & Chemical Corp. started construction of the plant last fall.

The first privately financed butadiene plant in the country, it is expected to go into operation late in 1956.

The plant is designed to produce up to 80,000 tons of butadiene a year, with later expansion intended to increase that capacity. However, plans call for limiting the initial butadiene output to about 60,000 tons annually to permit simultaneous production of about 2,500,000 gal. of avgas per year. Output of the two principal products will vary inversely, according to current demand *(The Oil and Gas Journal, November 28, page 57).*

Cost of the plant is estimated at $20,000,000 to $25,000,000. Requirements of butane and isobutane are expected to average about 9,400 bbl. daily when the plant first goes on stream and up to 12,000 bbl. or more daily after the plant is in full production at design capacity.

Upham Gas Sells

Dallas investors buy out properties for $5 million

DALLAS. — Upham Gas Co., West Central Texas producer, pipeliner, and gas distributor, has sold essentially all its properties for $5,000,000 to a group of private investors headed by Robert J. Bradley, Dallas oil man.

The properties changing hands include:

. . . Oil and gas production in Wise, Palo Pinto, and Jack counties, Texas. This consists of 20 gas wells and 31 stripper oil wells with reported bright water-flood possibilities.

. . . Proved gas reserves either owned or under contract totaling 21 billion cubic feet.

. . . Undeveloped leases totaling 13,000 acres in the Jack-Wise County area—much of it proved for gas production.

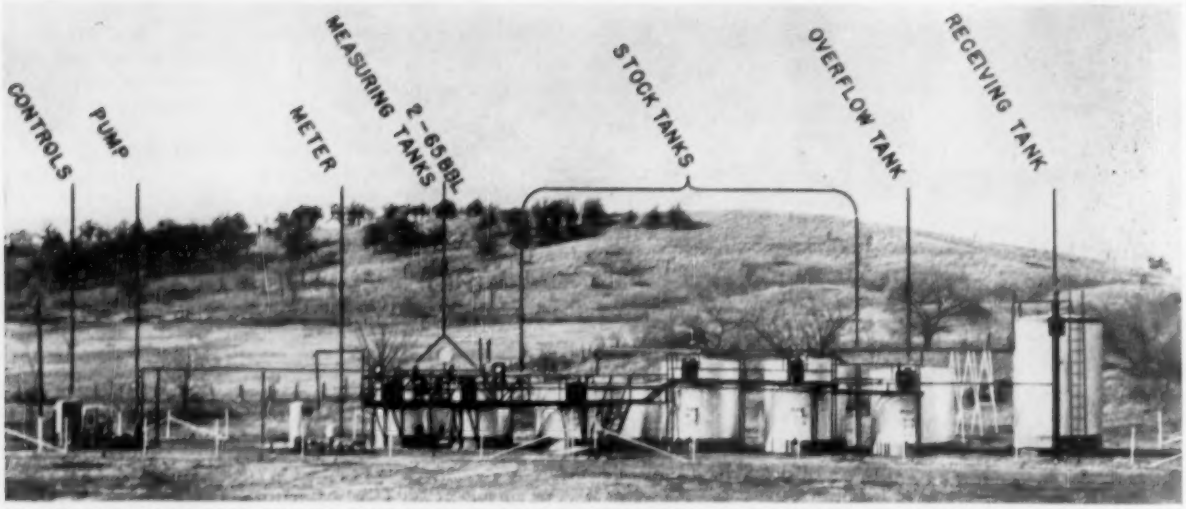
. . . Gas-transmission trunk lines total 176 miles.

. . . A natural-gasoline plant just south of Mineral Wells in Palo Pinto County with a capacity of about 50,000,000 cu. ft. a day.

. . . Gas-distribution facilities in 16 cities and towns in West Central Texas through which Upham last year distributed and sold over 5 billion cubic feet of gas.

The properties will be taken over and operated by newly organized Upham Gas Corp., headed as president by Bradley, who also is president of San Juan Exploration Co. and San Juan Oil Co., Dallas. Norman P. Hines, Mineral Wells, is executive vice president, and Lionel E. Gilly, secretary of San Juan Oil Co., is secretary and treasurer.

Upham Gas Co. was incorporated in 1922 by D. A. Upham. Control of the company has been retained by the Upham family since — recently under active management of Chester R. Upham, of Mineral Wells and Los Angeles.



GULF'S AUTOMATIC CUSTODY TRANSFER equipment is shown during demonstrations at Glenn Pool, Okla., before being moved to Kansas for actual operations.

Oil Sold Automatically

● Gulf reaches industry milestone: First crude transfer to pipeline on completely automatic and unattended basis

TULSA.—The first automatic sale of crude oil on a lease basis is now an accomplished fact.

The automatic custody transfer was made by Gulf Oil Corp. in cooperation with Kaw Pipe Line Co. at the Gulf Ames lease in Kansas' Bloomer pool. It followed more than a year of successful demonstration operations in Oklahoma's Glenn Pool.

Several companies are known to be experimenting with automatic transfer. But Gulf is believed to be the first to measure and run oil from the producer's tank to the connected pipeline on a completely automatic and unattended basis.

The usual procedure in oil transfers requires the presence of two men—a representative of the producer and the pipeline. They have to hand gage and test the oil and record its volume.

The Gulf sale is an industry milestone in progress toward unattended operation of leases. As automatic transfer wins acceptance, it will mean a reduction of labor needs for particular jobs in production and pipelining.

Acceptance is expected to be slow, however, as confidence in the accuracy of the automatic instruments must be built up.

Automatic transfer operation . . . Gulf's system has two parallel measuring tanks, temperature recording instruments, a sampling device, a b. s. and w. monitor, and an electrically operated system which automatically controls the filling and dumping of the measuring tanks.

Definite information has not yet been released on the automatic battery. But here are the general operating characteristics of such an equipment layout:

Oil from the receiving tank goes directly into one of the two 65-bbl. measuring tanks which are the heart of the system. These are closely calibrated tanks having two weir or spillover boxes to control the high and low levels. Each batch dumped to pipeline is the same volume.

During filling, a capacitance-cell instrument monitors b.s. and w. content of oil going into the metering tank. The instrument controls a bypass line and will divert bad oil. Oil with over 1 per cent water content goes back to the treater and will not enter the measuring tank.

Initially the measuring tank is filled to a level slightly above the edge of the top weir box. Excess oil drains through an outlet in the weir box to an overflow tank, leaving the oil level in the tank exactly even with the weir lip.

When oil drainage into the top weir box has stopped, a float switch in the box closes. This causes temperature of the oil to be measured and recorded and the pipeline valve to open. Like the high-level drain, the pipeline outlet is through a weir box, giving accurate setting of the lower draindown level.

An automatic sampler in the outgoing line takes a small, constant-volume sample at frequent intervals, the rate of sampling being proportional to flow. A composite sample is drawn which may cover several days' operation and many dumps of the metering tanks. Manual shakeouts and testing of the composite determines A.P.I. gravity and b.s. and w. content for accounting purposes.

Gross volume is recorded by a counter actuated each time the pipeline valve opens. Temperature recorded at the same time allows figuring of net volume.

Two metering tanks, installed to allow handling of more volume, reduce stock tank requirements, and smooth the pipeline flow. While one is dumping to pipeline, the other is filling and preparing to dump.

Colorado May Get New Tax

DENVER.—A bill pending in the Colorado Legislature seeks to levy a 5 per cent severance tax on the production of oil and natural gas.

The measure proposes a constitutional amendment to be voted on by the people next fall. It would replace the present controversial tax which, in the form of a gross income levy, imposes up to 5 per cent on production.

This tax, enacted in 1953, is being challenged in the courts as unconstitutional and discriminatory by The California Co. It yields about $3,000,000 annually.

A California Co. victory in the court would force the state to refund all money collected under the tax. By this spring, the revenue is expected to reach about $14,000,000.

Calco has indicated it might be willing to drop the suit if the severance-tax amendment is limited to 5 per cent.

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DUAL ZONE
PRODUCTION

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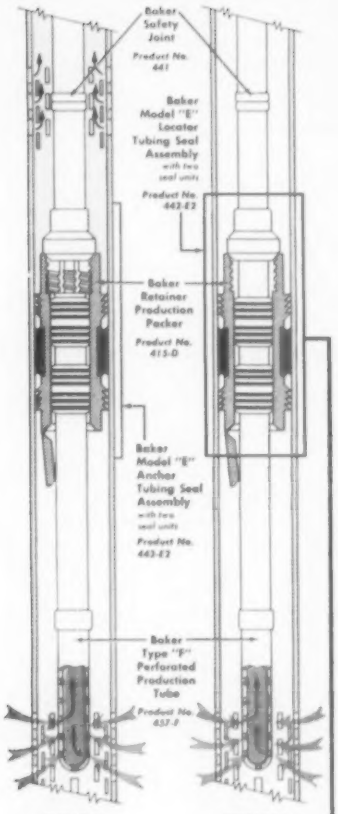
Baker Safety Joint
Product No. 441
Baker Model "E" Locator Tubing Seal Assembly
with two seal units
Product No. 443-E2
Baker Retainer Production Packer
Product No. 415-D
Baker Model "E" Anchor Tubing Seal Assembly
with two seal units
Product No. 443-E2
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TYPICAL SINGLE ZONE HOOKUP

Right: Picture shows actual detail of seal units

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Analyzer Tips Given

● Refiners exchange first-hand operating information at Texas A. & M. round-table discussion of stream analyzers

COLLEGE STATION, Tex.—Refiners are eager to grab any bit of practical knowledge on operating experience with the new process-stream analyzers.

They want to know when they should buy one for their plant, what can they expect in the way of maintenance on these complex instruments, and how dependable are they.

These and other questions cropped up during a round-table discussion at the eleventh annual Symposium on Instrumentation for the Process Industries at Texas A. & M. The following list covers the most important questions that were raised. The answers represent the collective ideas as they were summed up in informal group reports.

Q. What are the advantages of a continuous analyzer?

A. There are many. Costly and time-consuming laboratory work is reduced. Trouble is spotted immediately and upsets are prevented. The operator doesn't have to wait the customary 4 to 12 hours for laboratory tests to tell him what is happening in the process stream.

Off-specification time is cut, and unit efficiency is increased. By avoiding upsets and reruns, you may even be able to increase throughputs in some cases, because continuous analysis permits operation of the unit at maximum capacity. Analyzers can often measure elements which might otherwise go undetected.

The instruments also can be used in plant-scale research. As for their justification, some refiners may want to buy one and watch its performance, then decide whether others will pay off elsewhere in the plant.

Q. How about payout?

A. A $10,000 instrument has been known to pay out in a month. On the other hand, the economic factor is secondary in some operations. In research, the value may be intangible.

Q. What's the best way of selecting an analyzer for a particular unit which gives trouble?

A. A thorough study of the unit is essential. There have been many instances where an analyzer was ordered and installed only to be rendered useless by a minor modification which eliminated the trouble.

Q. Would the analyzer be a total loss in such a case?

A. It would depend on the unit. Perhaps so if the unit were designed, say, to measure moisture content in an alkylation unit and then the moisture source were removed. But if the instrument were used on a light-ends column in one part of the plant, it could be shifted to similar duty elsewhere.

Q. How important is versatility?

A. It may mean the difference between zero salvage value and maybe even 100 per cent salvage value. This factor should not be ignored when establishing a continuing need for the instrument.

Q. What is the minimum need to justify an analyzer?

A. Generally, it's felt there should be about a 2-year need. In research, the period might be extended to 5 years.

Q. Are analyzers dependable?

A. The answer here is a qualified "yes." There are shortcomings, but the instruments are being improved continually. The electronic circuits used extensively require tubes, and these tubes are susceptible to vibration, jars, and similar disturbances. But with the magnetic-type amplifiers and transistors which are coming into the picture, circuits should be strengthened and overall dependability increased.

Q. What is the maintenance problem?

A. Since the analyzers are complicated and new, someone in the plant must be taught to master them before they can be used with confidence.

Q. Are instruction manuals adequate?

A. They usually outline step-by-step procedures by which trouble can be isolated. Where they fall short is in theoretical information. An instrument engineer needs a more fundamental knowledge to learn why a unit is acting up.

Q. How can maintenance be made easier?

A. One suggestion is the use of plug-in type electronic components. A standby unit could be kept on hand to replace a faulty one in a matter of minutes. Repairs could be made leisurely with a minimum of down time.

Many of the installations are in hazardous areas where it would be inadvisable to make field repairs or try to isolate the trouble. Manufacturers could help here by building in monitor circuits. They could be used to check out the instrument without opening the cover. In temperature-controlled instruments, provision should be made for testing without disturbing temperature conditions. Control knobs could be extended beyond the case.

Q. How high should maintenance costs run?

A. They will vary, especially while you're becoming acquainted with a new unit. A good figure to shoot at is an annual maintenance cost of 10 per cent of the original investment.

Q. What are the major troubles in using continuous analyzers?

A. The big headaches are fouling due to sample stream, internal and external corrosion, and the problems of educating instrument men and keeping competent maintenance personnel. Only a high-caliber electronics man will fit the bill.

Record Well Jinxed

Crews now fishing for drill pipe stuck in open hole

PORT SULPHUR, La.—Richardson & Bass has run into trouble trying to get back to the promising-looking sands in the bottom of its world's deepest well. Late last week, the crews were fishing for drill pipe that stuck in the open hole below the 5-in. liner set to 21,809 ft.

A 4⅛-in. bit on 2⅞-in. flush-joint drill pipe was used to drill out the liner plug and clean out the old open hole below it. The bit got as far as 22,035 ft. where the drill pipe became stuck. At last report, the crews had backed off the pipe to 21,300 ft. and were preparing to run a pulling tool to try to recover the remaining pipe.

The 1-L Humble-LL&E-State Lease 2414 reached its record depth almost a month ago, and an electric log showed three good prospect zones below 21,500 ft.

Richardson & Bass failed to get the hole cased to bottom because 5-in. liner stuck at 21,809 ft. and had to be cemented there. One of the zones logged is behind this liner, but two are below it.

To get to the lower zones, the company planned to clean out the old hole to total depth, and cement a 2⅞-in. liner to bottom. This would permit testing the lower sands.

Deep Well Stymied

Faulty cement job forces operator to hold up tests

CHICKASHA, Okla.—British-American Oil Producing Co. ran into more trouble last week trying to bring in its Grady County wildcat as Oklahoma's deepest producing well.

Testing operations were stymied temporarily when operator perforated 5-in. liner opposite the third Bromide sand at 15,080-81 ft. and found the cement job was faulty.

At mid-week the company was preparing to squeeze cement through the perforations.

British-American ran into its first trouble at the 2 Harrison, a deep test in shallow Carter-Knox field, the previous week. The 5-in. liner was stuck 60 ft. off bottom at 15,250 ft. Efforts to free the liner failed and it was cemented at 15,250 ft.

Prospects appeared good in spite of the difficulty, that the well would set a new producing-depth record in Oklahoma. The wildcat early in January developed a flow of 13,750,000 cu. ft. of gas daily during a drill-stem test of the second Bromide sand at 14,960 ft. *(The Oil and Gas Journal, January 9, page 64).* The well would be the state's deepest producer if production is developed at this depth or below.

Plant Completed

Dedication scheduled for Florida petrochem works

PENSACOLA, Fla.—Formal dedication will be held February 17 for Escambia Bay Chemical Corp.'s multimillion - dollar, anhydrous - ammonia plant here. The plant already is turning out 200 tons daily of anhydrous ammonia and nitrate fertilizers for distribution in eight southern states.

The company this month let contracts for a polyvinyl chloride resin plant to be built near the present facility. It will have a capacity of 30,000,000 lb. per year. Completion is scheduled late in 1956.

Escambia Bay Chemical was formed late in 1954 by United Gas Corp., Electric Bond & Share Co., and the National Research Corp. Its first corporate name was Gulf Chemical Co. but later was changed.

Ground for the ammonia plant was broken April 29, 1955, and production began December 28. Natural gas used as a feed stock for the ammonia is furnished by United Gas Pipe Line Co., a United Gas subsidiary.

Little Inch Deal Back to FPC

WASHINGTON.—Conversion of the Little Inch pipeline from gas to oil may be delayed while the Federal Power Commission makes a new study.

The Federal Circuit Court of Appeals threw a monkey wrench into Texas Eastern Transmission Corp.'s plan last week.

It announced it would send the case back to the FPC after a showing by Harold Leventhal, counsel for two Mississippi barge operators, that the commission had refused to accept evidence on points raised by his clients.

Conversion of the Little Inch line has been fought by the Chotin Towing Corp. and Greenville Towing Co., as well as the city of Pittsburgh. The barge operators contended the conversion would take traffic from the Mississippi-Ohio rivers, reducing the transportation facilities available in the event of emergency.

It was also contended that Texas Eastern should not be allowed to absorb losses from product transportation out of revenues from natural gas, and that the conversion would result in higher gas prices to consumers not in the public interest.

Naff optimistic . . . In Shreveport George T. Naff, Texas Eastern president, said his company will "pursue actively" its plans to convert the line.

"And it is hoped," he continued, "that the additional hearings required by the court's action will not delay greatly the date on which the reconversion can be accomplished."

Naff said the court decision will have no effect on a big expansion program, now before the FPC, which will include a new line to the Mexican border.

The court ruling was in the unusual form of a memorandum in advance of its decision.

It took this action on the basis of information that the Little Inch line was to be taken out of service this month, preparatory to substituting pumps for compressors. The first products are scheduled to move through the line in June.

Processing BRIEFS

PAULSBORO, N. J.—Socony Mobil Oil Co., Inc., soon will add a 22,000-bbl. daily catalytic hydrodesulfurization unit at its refinery here. Foster Wheeler Corp. will build the unit, scheduled for March 1957 completion. Socony Mobil's German subsidiary will build a similar 5,500-bbl. daily unit at Bremen. It is contracted to C. F. Braun Co.

SARNIA, Ont.—Imperial Oil, Ltd., soon will begin a $3,800,000 project at its refinery here to make 30,000,000 lb. per year of dodecyl benzene detergent alkylate. The program also includes plans for other alkyl aromatic compounds, plus propylene trimer and tetramer. When completed in mid-1957, the plant will displace Canada's current $2,500,000 annual import of detergents.

LULING, La.—Monsanto Chemical Co. is moving to take advantage of its merger with Lion Oil Co. last October. The company has started a new plant to process adipic acid. Described as a major-expansion in production of this resin intermediate, the multimillion-dollar plant will be integrated with raw-material facilities at Lion's ammonia plant here. Adipic acid is used in nylon manufacture and also in polyurethane foams for various cushioning purposes. Completion is due early next year.

NEW YORK.—Ten years of study have gone into a new American Petroleum Institute publication just released on "Recommended Practice for the Design and Construction of Pressure-Relieving Systems in Refineries." The publication designated (Tentative) (RP-500), is the work of a representative group of engineers in the A.P.I. subcommittee on pressure - relieving systems, of the Division of Refining.

It is described as "not the final word, but a start toward the establishment of order after a somewhat chaotic period." It is available at $1.50 per copy from J. A. McNally, American Petroleum Institute, 50 West West 50th Street, New York 20, N. Y.

PONCA CITY, Okla.—Continental Oil Co. has put into operation a $450,000 dairy-wax plant addition to its refinery here. The installation has a capacity of 11 million pounds of dairy wax annually, boosting Conoco's annual output to 20 million pounds. Conoco delivers the wax to dairies in liquid form for use in coating milk cartons and other dairy-product containers.

LOUISVILLE, Ky. — Consolidated Chemical Industries, Inc., has been merged into Stauffer Chemical Co. and will be operated as a subsidiary. Stauffer has owned a substantial interest in Consolidated for years.

World Output Hits Peak

Record production in U. S. boosts noncommunist nations to new mark of 14,260,500 bbl. per day during November

RECORD crude output in the United States paced free-world production to another new high in November.

U. S. output averaged 7,013,000 bbl. daily, an increase of 182,000 bbl. daily, or 2.7 per cent, over October. It was the first time that domestic wells produced more than seven million barrels daily.

The increase in the United States accounted for nearly 70 per cent of the over-all gain of 263,500 bbl. in total free-world output, which averaged 14,260,500 bbl. daily. But records fell in several other countries. And total output in the Western Hemisphere outside the United States, in Western Europe, and in the Middle East was higher than ever before.

Venezuela, Canada, go up . . . In Venezuela, output rose 44,100 bbl. daily, or 2.2 per cent, to a record 2,259,500 bbl. daily, or almost one-third the level of U. S. output. The new Venezuelan record was the fourth in a row. It was 114,800 bbl. daily, or 5.3 per cent, over the 11-month average, which itself was up 267,100 bbl. daily, or 14.2 per cent, over the same period 1 year ago.

Canada was another Western Hemisphere country with recent notable increases. November output passed the 400,000 bbl. daily mark for the second time. Production reached 410,000 bbl. daily, up 5,000 bbl. daily over October, and was the fifth new mark set in 1955.

Middle East production edged up 7,800 bbl. daily. In Iran, the consortium produced an average of 383,000 bbl. daily, the highest since nationalization, and an increase of 33,000 bbl. daily over the preceding month. Saudi Arabian output passed the million-barrel mark for the second straight month.

Kuwait, Iraq decline . . . These gains were offset by declines in the other two major Middle East producing countries. Kuwait was down 35,500 bbl. daily to 1,091,500 bbl. daily, which was 7,100 bbl. daily under the 11-month average. Iraq averaged 684,700 bbl. daily, off 30,400 bbl. daily from the previous month, and 2,900 bbl. daily under the yearly levels.

Record production also was reported from two of the smaller exporting countries, where output hinges upon field development more than fluctuations in world demand. These were Trinidad, where the average reached 73,000 bbl. daily for the first time, and the Persian Gulf shaikhdom of Qatar where output rose to 121,600 bbl. daily.

Western Europe increases . . . New highs were recorded by three Western European countries, where even comparatively small domestic output is important for nations trying to reduce foreign spending. West Germany reached 64,000 bbl. daily for the first time. It was the eighth new high in 9 months.

Increased production from Ragusa field, Siciliy, brought total Italian output to 5,900 bbl. daily. The field, operated by a Gulf Oil Corp. subsidiary, recently produced its one-millionth barrel.

In France, output from Esso Standard, S.A.F.'s new Parentis field reached 19,500 bbl. daily. The field, discovered in 1954, now accounts for around 80 per cent of French production.

TREND OVER THE LAST YEAR

1954	Western Hemisphere less U. S.	Middle East	Total non-Communist foreign
November	2,858.9	2,842.7	6,219.3
December	2,975.7	3,001.8	6,453.3
1955—			
January	3,001.5	2,950.1	6,442.5
February	3,050.4	3,109.3	6,653.8
March	3,036.0	3,247.9	6,775.8
April	2,981.6	3,327.6	6,805.9
May	2,932.1	3,287.4	6,718.8
June	3,019.7	3,201.6	6,720.9
July	3,092.7	3,275.8	6,872.1
August	3,140.4	3,243.0	6,978.2
September	3,130.9	3,256.9	6,990.7
October	3,179.6	3,378.2	7,166.0
November	3,249.9	3,386.0	7,247.5

CRUDE-OIL PRODUCTION
(Daily average in thousands of barrels)

Country—	Nov. 1955	Oct. 1955	Nov. 1954
W. Hemisphere:			
Argentina	83.9	83.9	88.2
Bolivia	7.7	8.3	6.0
Brazil	6.6	6.4	4.3
Canada	410.0	405.0	276.4
Chile	8.5	8.5	5.2
Colombia	112.4	112.4	104.4
Cuba	1.4	1.4	0.4
Ecuador	10.0	10.0	8.8
Mexico	230.0	210.0	236.0
Peru	46.9	46.9	46.5
Trinidad	73.0	71.4	67.3
Venezuela	2,259.5	2,215.4	2,015.4
Total	3,249.9	3,179.6	2,858.9
W. Europe and Africa:			
Algeria	1.1	1.1	1.3
Austria*	67.7	68.6	
France	24.8	21.3	14.8
Fr. Morocco	1.9	1.9	2.4
W. Germany	64.0	63.9	55.4
Italy	5.9	5.2	1.4
Netherlands	19.6	19.7	18.9
Egypt	36.7	36.4	37.1
United Kingdom	1.2	1.2	1.2
Yugoslavia	4.9	5.1	4.8
Turkey	6.4	6.4	1.9
Total	234.2	230.8	139.2
Middle East:			
Bahrain	30.1	30.1	30.2
Iran†	387.0	354.0	145.0
Iraq	684.7	715.1	614.8
Kuwait	1,091.5	1,127.0	1,029.4
Neutral Zone	30.0	30.0	30.0
Qatar	121.6	119.6	110.3
Saudi Arabia	1,041.1	1,002.4	883.0
Total	3,386.0	3,378.2	2,842.7
Other Asia:			
British Borneo	110.0	110.0	99.4
Burma	4.0	4.0	3.7
India	7.5	7.5	7.0
Indonesia	236.0	236.0	244.1
Japan	6.3	6.3	6.0
New Guinea	7.9	7.9	12.8
Pakistan	5.7	5.7	5.5
Total	377.4	377.4	378.5
Total Free World outside U.S.	7,247.5	7,166.0	6,219.3
United States	7,013.0	6,831.0	6,345.6
Total Free World	14,260.5	13,997.0	12,564.9
Communist Countries in Soviet Orbit:			
Russian Zone of Austria*			57.5
Romania	150.0	150.0	125.0
Russia	1,400.0	1,400.0	1,185.0
Others	50.0	50.0	36.8
Total	1,600.0	1,600.0	1,404.3
World total	15,860.5	15,597.0	13,969.2

*Austria took over its producing fields from Russia in August 1955.

†Includes an estimated 4,000 bbl. daily from Naft-i-Shah field not operated by the consortium.

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Communist countries in the Soviet orbit include satellite countries in Europe and Red China.

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CORROSION AND FOULING

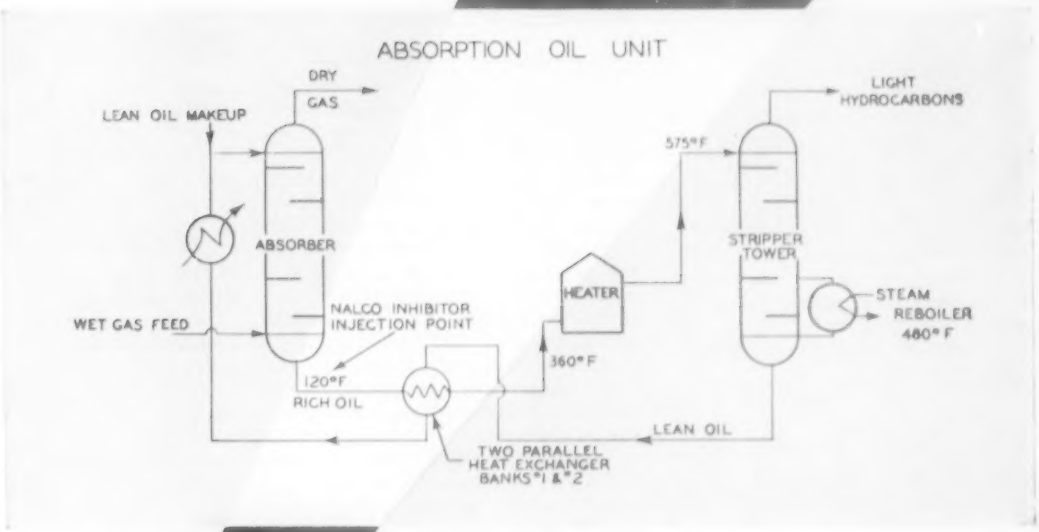
INHIBITORS

THE PROBLEM:

Severe fouling of heat exchangers in a cat cracker absorption oil system where temperatures range up to 575° F.

THE TREATMENT:

Nalco Inhibitor added at 20 parts per million to the absorption oil in the system.



THE RESULT:

Pressure drop across exchanger banks reduced from an average of 95 psi to an average of 12 psi by the detergent-dispersant action of Nalco Inhibitor. And for the first time in plant history, the exchanger banks required *no manual cleaning* after months of operation.

There's more to the story, too—because Nalco Inhibitors were then tried in another absorption system, and performed so successfully they are now used at a number of other locations within the refinery. If yours is a similar problem of fouling, corrosion or hydrogen blistering, it will certainly pay you to look into these amazing Nalco Inhibitors. Talk it over with your Nalco Representative or write direct.

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Kuwait Looks Offshore

Shaikhdom plans to offer concessions near one of world's biggest producing areas; boundary dispute may interfere

KUWAIT, the small Persian Gulf shaikhdom with more known oil reserves than any other country in the world, is preparing to auction offshore concessions.

The shaikh will accept bids for both Kuwait and the Neutral Zone, according to his London representative. The Kuwait Government is at present drawing up model concession bids to guide companies.

Because of the shaikhdom's small 3,600-sq.-mile area, any offshore concessions would lie within a few dozen miles of one of the world's most prolific producing areas.

Boundary problem . . . But despite steps being taken to grant concessions, official acceptance of bids is not looked for in the immediate future.

One drawback is the question of boundaries. Offshore boundaries have never been established between Iraq and Kuwait.

A similar situation is believed to exist between Kuwait - Neutral Zone-Saudi Arabia offshore demarcations. At one time, Iran laid claim to the entire Prsian Gulf bottom, and there is an outside chance that it could reassert the claim.

Commitment to Britain . . . At present, all production in the British protectorate is controlled by Kuwait Oil Co., Ltd., jointly owned by Gulf Oil Corp. and British Petroleum Co., Ltd.

Gulf originally sought a concession early in the 1930's, but was required to set up a British corporation and associate with British Petroleum (Anglo-Iranian). These stipulations resulted from a pledge the ruling shaikh had made to the British after World War I in return for protection from the turks.

Whether Kuwait's offshore areas are considered in the same category as its land, and whether the early agreement remains in effect, could have an important bearing on concessions. There is an indication that the early agreement may no longer be binding. The shaikh's undivided interest in the Neutral Zone, however, was granted to a non-British firm, American Independent Oil Co. (Aminoil).

Present production . . . Last year, output averaged 1,092,600 bbl. daily, up 14.7 per cent over 1954.

Production comes from about 175 flowing wells. Burgan field, with 133 wells and Magwa-Ahmadi with 42, are located in southeast Kuwait, within 10 miles of the Persian Gulf.

Unofficial sources say that the Raudhatain well, a discovery in northern Kuwait which is now under test, may turn out to be the most prolific producer in the Middle East. *(The Oil and Gas Journal, January 30, page 136).*

Refinery Expanded

New capacity will enable Mexico to reduce imports

PETROLEOS MEXICANOS is getting set to dedicate formally its refinery expansion project at Minatitlan. The nearly complete program already has boosted capacity of the Minatitlan plant from 24,000 to 50,000 bbl. daily —and begun curtailing Mexico's $40,-million yearly gasoline import business.

Included in the Minatitlan expansion and modernization is a T.C.C. unit with a fresh feed capacity of 10,000 to 12,-000 bbl. daily and a total capacity of 15,000 bbl. daily. The project was contracted by Fluor Corp., Ltd.

Production from the expanded refinery will move through a 60-mile pipeline to the Pacific side of the Isthmus of Tehuantepec. From there tankers will carry it to Lower California, Sonora, Sinaloa, Nayarit, and Colima. These areas heretofore have been served by product shipments from U. S. West Coast refining areas.

Reds Start up New Line

Russia reports that its newest long-distance pipeline, which extends from the Tuimaza fields in the "Second Baku" area to the new refinery at Omsk in southwestern Siberia, is now carrying "substantial quantities" of petroleum products, although some parts of the project are still unfinished.

More than 825 miles long, the pipeline from Bashkiria crosses the southern Ural Mountains and feeds a vast area formerly dependent on railroad tank cars. When in full operation, the Tuimaza-Omsk line will be an important source of fuel for northern Kazakhstan, where the U.S.S.R. is plowing up millions of acres of virgin land to plant badly-needed crops.

International BRIEFS

Skiles Oil Corp., Mt. Carmel, Ill., has acquired 500,000 acres in oil concessions on the east slope of the Peruvian Andes. The company has opened an office in Lima, with Dr. Carlos Neuhaus Rizo-Patron as general manager.

Standard Oil Co. of California is not planning to build a refinery at Colon, Panama, company officials said last week. A spokesman denied current reports that the firm plans a $40,000,-000 refinery to operate on Venezuelan crude. He said the report was apparently the result of a misunderstanding "but such a project is not contemplated."

Petroleos Mexicanos last week inaugurated its new 45-mile, 8-in. products line. The line connects the Salamanca refinery with a new storage and distribution plant at Aguascalientes.

Italy's first Platformer, a 2,000-bbl. daily unit at Porto Marghera refinery at Venice, has gone on stream. The refinery is owned by British Petroleum Co. and Azienda Generale Italiana Petroli.

The new unit is the seventh Platformer to be added to B.P. refineries in the past 18 months.

Gulf Italia Co. (Gulf Oil Corp.) has produced its millionth barrel of oil in Sicily since it began operations in October 1953. The company is now producing from eight wells in its Ragusa field and expects to be producing 13,000 bbl. daily by the end of 1956.

Hungary has announced plans for a major petrochemical plant that will process Romanian natural gas. It will produce polyvinyl chloride, acrylonitrile polymer, and ammonia fertilizers. Other products will include caustic soda, ethylalcohol, dyes, and raw materials for other industries. Completion is scheduled for early 1957.

Hungary and Romania will jointly build a 220-mile pipeline from Romanian fields to the plant under a mutual aid agreement. Eighty miles of the line will lie in Hungary.

The boilers of Attock Oil Co., Ltd.'s 4,000-bbl.-daily refinery at Rawalpindi in northwestern West Pakistan are now operating on natural gas. The company has just completed a 6-in. gas pipeline from the oil field at Dhulian to the refinery, a little less than 60 miles. Use of the gas, which has been flared in the past, will save the company about 1,000 tons of fuel oil a month.

Refinery Job Let

Standard-Vacuum starting modernization in Sumatra

STANDARD-VACUUM OIL CO. has let contracts for its $20-million modernization program for the Sungei Gerong refinery near Palembang, Sumatra.

Foster Wheeler Corp. will build the two major process units, a 11,100-bbl. daily fluid cat cracker and a 1,200-bbl. daily catalytic polymerization unit.

These and other improvements at the 71,000-bbl. daily refinery operated by Stanvac's subsidiary, Standard-Vacuum Petroleum Mij., will take about 2½ years to complete. They are part of the company's 4-year, $80-million capital investment program in Indonesia *(The Oil and Gas Journal, January 24, 1955, page 76)*.

The new cracker will supplement prewar thermal-cracking units now being used to produce gasoline and other products. It will also provide feed stock for the refinery's 800-bbl. daily alkylation unit which produces aviation-gasoline components. Light ends from the cracker will be compressed and segregated as feed stock for the nonselective cat poly unit.

Esso Research & Engineering Co. handled the process design for the new units and will supervise construction. The other contractors included Westinghouse International, power-generating facilities and large gas turbines; Raymond Concrete Pile Co., foundations; Chicago Bridge & Iron Co., tankage; Chemical Construction, Ltd., sulfuric-acid plant; Volker Mij., dredging and sand fill; and Engineers Associated, employe housing.

Albania Refinery Delayed

Albania expects to put its largest oil refinery into operation this year after overcoming difficulties that have thrown the project at least 18 months behind schedule.

The new unit, located at Cerrick, has a capacity of 150,000 metric tons of oil products annually. When in full operation, it will completely satisfy Albania's requirements for all types of fuel, according to the Soviet press.

Australia Test Deepened

Testing of gas shows encountered in Australia's deepest well has been abandoned and the well, Cape Range 2, is being deepened.

The well, being drilled by West Australian Petroleum Pty., Ltd., was plugged back from total depth of 15,047 ft. to test gas shows in a Jurassic section from 9,886 to 10,098 ft. *(The Oil and Gas Journal, January 16, page 88)*. Testing was suspended last week and the well was drilling ahead below 15,047 ft.

Across the continent to the southeast, shallow oil shows encountered by a stratigraphic test being drilled by South Australia Northern Territories Oil Syndicate (Santos) sent the syndicate's stock gyrating on Australian exchanges. John Bonythos, managing director of Santos, said last week the well found oil shows at about 800 ft. and tests were planned. The well, Wilkatana 1, is near Port Augusta in the Pirie-Torrens basin of South Australia.

Pemex Starts Plant

Absorption facility due for completion this year

PETROLEOS MEXICANOS has let the contract for a second 300,000 M.c.f. daily capacity gas-absorption plant to be built in Mexico's isthmus State of Tabasco.

Hudson Engineering Co., the firm which built the new plant's twin at Reynosa in northern Mexico, will handle construction of the new unit. The Tabasco plant is expected to be completed this year along with a 22-in. natural-gas pipeline to the port of Minatitlan on the Gulf of Mexico.

Antonio Bermudez, general director of Pemex, says the sulfur industry has already contracted for 100,000 M.c.f. of the gas and that other new industries expected to develop in the region south of Vera Cruz will use the balance.

The new plant is part of a general expansion Pemex plans for this year in Tabasco where it plans "Ciudad Pemex," an oil city. The area is believed to have an oil and gas productive potential greater than any in Mexico's already developed fields.

The Reynosa plant was completed in the fall of 1955 at a cost of $7 million. Pemex is selling 90,000 M.c.f. of gas daily to distributing companies serving Monterrey. The remaining 210,000 M.c.f. will be the supply from which Texas Eastern Transmission Corp., will buy from 100,000 to 200,000 M.c.f. for import into the United States *(The Oil and Gas Journal, September 5, 1955, page 66; October 3, 1955, page 98; and December 26, 1955, page 136)*.

KUWAIT CORRECTION

The top capacity of 3,000,000 bbl. per day given for the Kuwait tanker-loading terminal *(The Oil and Gas Journal, January 23, page 74)* was overstated. Actual size of the terminal can be judged by its repeated handling of 1,100,000 bbl. daily.

D'Arcy continues 20-year search on British Isles

EVEN if the oil it finds doesn't make much of a splash in the world-production picture, D'Arcy Exploration Co. (British Petroleum) is still plugging away in its 20-year search for production in the United Kingdom.

The company's latest discovery is a field at Egmanton in the East Midlands about 6 miles from its field at Eakring, Nottinghamshire. The discovery well (see photo) produced about 40 bbl. daily from a 3,500-ft. zone. Two more small producers have been drilled in the field.

It has been reported D'Arcy is planning a 40-well development program in Egmanton.

At Plungar field in Leicestershire, which D'Arcy discovered in 1953, two more producers have been drilled. The small field now has four wells producing about 150 bbl. daily. More drilling is being done in this field also.

The addition of Egmanton field gives the United Kingdom a total of seven small oil fields, mainly in the Nottingham area. D'Arcy has 230 wells in the entire country producing about 1,200 bbl. daily.

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SOCONY MOBIL OIL COMPANY, INC.
AURORA GASOLINE COMPANY
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SHELL CHEMICAL CORPORATION
CALLERY CHEMICAL COMPANY
SINCLAIR REFINING COMPANY
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Test Drills Ahead

Island off Haiti is site of Mecom-Andrews wildcat

THE second wildcat in a three-well program on Ile de la Gonave, an island off Haiti, was drilling below 7,500 ft. last week, headed for its projected 8,000-ft. depth.

The drilling program was undertaken last June by a syndicate headed by Mark Edwin Andrews, Houston, in exchange for a ¾-interest in the 180,000-acre island. Commonwealth Oil Co., Houston, has a 50-year exploratory concession for all of Haiti. Under the agreement made with the Andrews interests, Commonwealth retains a quarter interest in the island without contributing to the costs of the program.

Half interest in the syndicate's share of the operation has been acquired by John W. Mecom, Houston independent. In addition the Mecom-Andrews interests have an option on another 120,000 acres of Commonwealth's mainland concession.

The first well, drilled on the northwest beach of the elongated island in the Gulf of Gonaives, was abandoned when drill pipe twisted off at 3,158 ft. and a fishing job was unsuccessful. The second well is about half way up the slope of the island. Andrews said the third is planned on the crest of the Gonave anticline just as soon as the well now drilling reaches its projected depth.

In addition to the Haitian concession, Commonwealth holds oil and mineral leases on more than 1,250,000 acres of land and offshore areas of Florida.

Altona Reformer on Stream

A 6,000-bbl. daily Sovaformer, the third to be built in the world, has gone on stream at Standard-Vacuum Oil Co.'s Altona refinery 12 miles from Melbourne, Australia.

The 29,200-bbl. daily refinery was completed in April 1955, and had the only catalytic cracker in Australia until the Kwinana refinery operated by Australian Petroleum Refinery, Ltd. (British Petroleum Co.) went on stream several months later.

Siboney Spuds Cuban Test

The first exploratory test on Siboney Development & Exploration Co.'s 5,000,000-acre Cuban concession has been spudded in near the southern coast of Camaguey Province.

The Cacique G 1, 16½ miles north of Santa Cruz del Sur, is projected to around 5,000 ft. to test the Lower Cretaceous. The location is more than 100 miles southeast of Jatibonico field, which produces some 1,200 bbl. daily from the Upper Cretaceous at 1,100 ft.

The site was selected on the basis of extensive surface geology, gravity meter, and seismograph work. Simpson Drilling Co. of Cuba has the drilling contract. Siboney, organized by Crescent Corp. and Sterling Oil of Oklahoma, Inc., two Tulsa firms, may spend up to $2,000,000 the next 2 years exploring its concessions *(The Oil and Gas Journal, November 21, 1955, page 343)*.

Assam Completes New Well

Assam Oil Co., Ltd., has completed its eighth producer at Nahorkatiya field, northeast India.

The well, No. 11, yielded crude from sandstone between 9,660 and 9,785 ft. Production details were not given. But earlier wells in the field flowed around 500 bbl. daily.

Total depth of the new producer was 10,360 ft. It was completed 38 days after spudding in, the fastest time ever recorded in India for a well that deep.

A well at Naholia is drilling ahead at 11,100 ft. and promises to become the deepest test ever drilled in Asia. It is located in the company's new Hugrijan prospecting license area of Assam. The depth record is now held by Lakhra 1 in Sind, Pakistan, at 12,666 ft.

West German Output Up

Crude production in West Germany in 1955 jumped 18 per cent over output in 1954.

Preliminary figures for 1955 indicated the daily average output for West German fields was 61,224 bbl., compared with 51,865 bbl. daily for 1954.

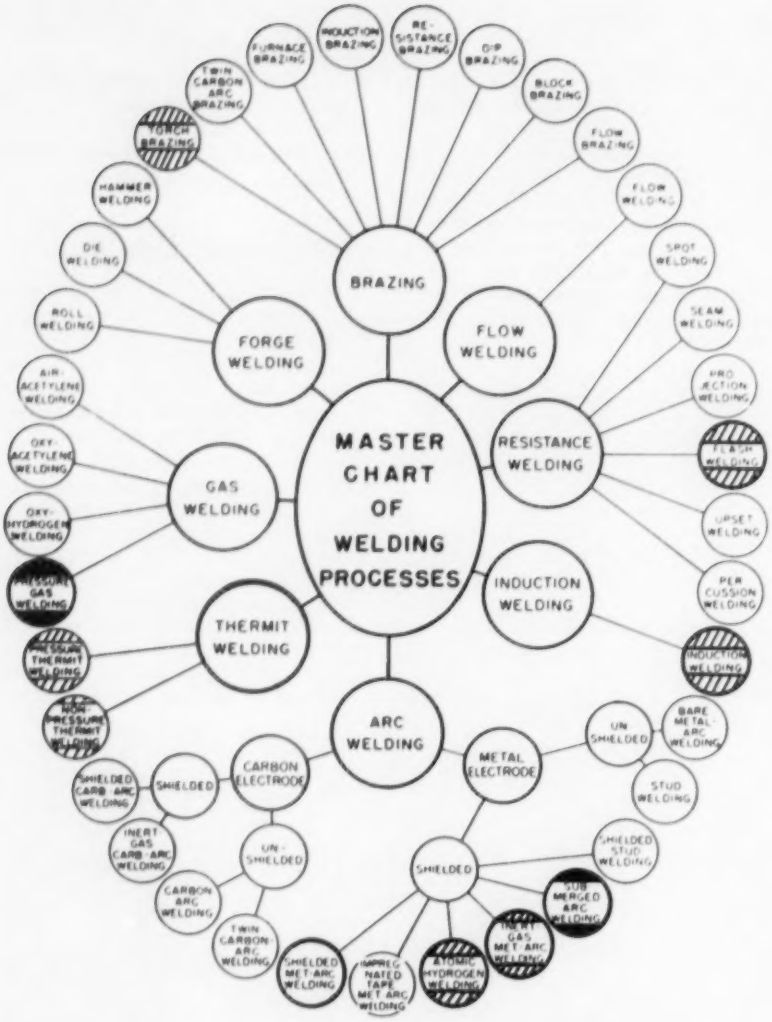
At the same time, Wirtschaftsverband Erdoelgewinnung, the association of West German crude producers, estimated that the country's output will climb steadily to 73,200 bbl. daily by 1960. The association's latest estimates for future output are 65,500 bbl. daily in 1956; 69,400 bbl. daily in 1957; 71,000 bbl. daily in 1958; 72,100 bbl. daily in 1959, and 73,200 bbl. daily at the end of the next 5 years.

B.P. Expanding Its Hamburg Refinery

THIS recently completed gas-recovery plant is the latest process addition to the Hamburg refinery of B. P. Benzin und Petroleum-G.m.b.H. (British Petroleum).

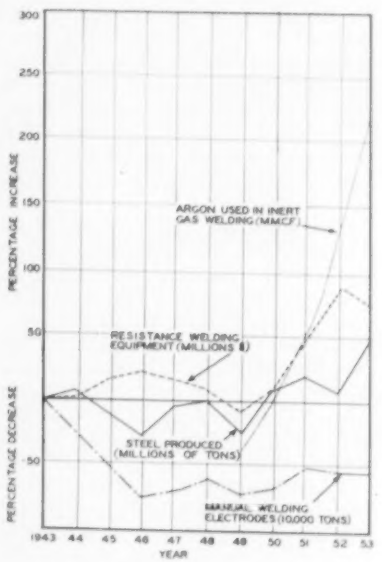
The new unit has been producing about 1,000 bbl. daily of butane and propane for the past several months. The output is being used for German domestic and industrial purposes and in the manufacture of chemicals.

The gas-recovery unit went on stream at the 30,000-bbl.-daily refinery just a few weeks after the company began building a 6,000-bbl.-daily Hydrofining unit for desulfurization of diesel oils. The unit under construction will use catalytic reformer hydrogen.



NONMANUAL processes which have been tried and largely discarded for pipeline welding are indicated by the blacked circles in the master chart. Shaded circles show processes discussed in this article as having possibilities for pipeline welding.

RELATION of resistance, inert gas, and manual electric-arc welding in shop operations in the United States is shown in the chart below. Note the rapid increase in growth of the inert-gas welding processes from which the new carbon dioxide welding process is an offshoot.



What's Ahead in Nonmanual Welding?

Here's a discussion of its possibilities for pipelining, based on an investigation of the subject by the Journal's pipeline editor for Esso Research & Engineering Co.

by Paul Reed
Pipeline Editor

WHAT are the prospects for getting a welding process for pipelining that does not depend on manual skill—a nonmanual welding process? This article presents the high points of what has been found in the investigation of the subject conducted by Esso Reseach & Engineering Co.

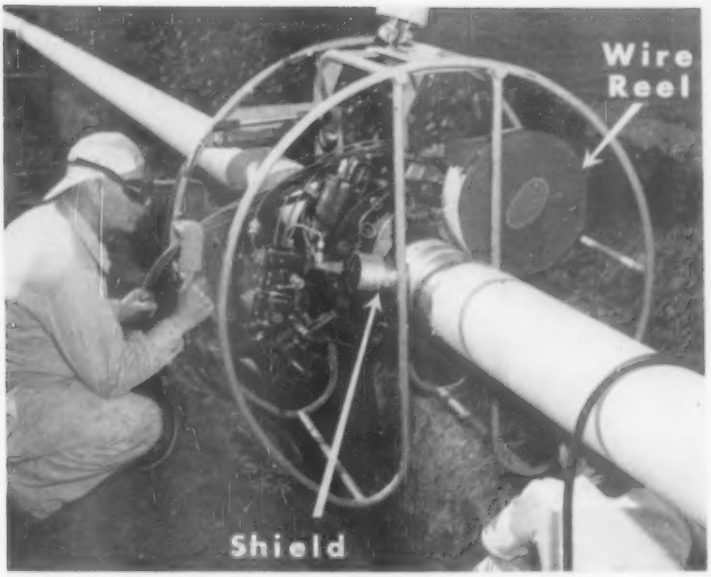
A new carbon dioxide process is the most promising even though important defects must be corrected before it becomes practicable. Several other processes also have possibilities for being adapted to pipelining.

Nonmanual welding includes automatic welding and semiautomatic welding of several kinds and some welding processes of a chemical nature. Out of this group may come one or more welding processes which will bring changes as great in the next 20 years as the transition from screw pipe to gas and electric arc-welding processes.

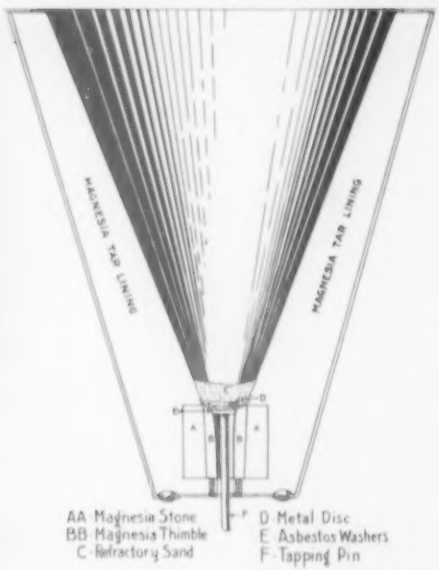
Eighty processes . . . Altogether there are about 80 known welding processes today; 38 of these have been commercialized. Some large shops that are fabricating for the aircraft and automobile industries are using as many as 12 different welding processes in a single shop, and most of these 12 do not de-

The Journal's pipeline editor presented this paper before the eighth annual convention of the Pipe Line Contractors' Association, Boca Raton, Fla., January 16-18, 1956.

PIPELINING



WELDING UNIT revolving around 8-in. aluminum pipe for applying the inert gas (argon or helium) shielded-arc process with consumable electrode. Development work on the new carbon dioxide process for welding steel pipe was later done with the use of this same machine.



IN THERMIT PROCESS thermit material is ignited and reaction occurs forming molten metal which pours into a mold after it is released by pushing up tapping pin at bottom of crucible.

pend on manual skill in the actual making of the weld.

Organizations with the widest experience in the application of welding processes are the United States Navy, federal Government arsenals, and large electric manufacturers that weld everything from small household electric fans to big turbines and jet engines. These companies are going more and more toward automatic and other forms of nonmanual welding.

As yet none of these processes is now ready to go out on a pipeline right-of-way, and it does not look as though any of them will be ready for testing on a pipeline job for at least a year. Manual electric-arc welding used in pipelining, now thoroughly established as a highly developed and versatile technique, is a tough competitor for any new welding process to go up against.

Pipeline possibilities . . . These processes, listed in the order of their availability have possibilities for nonmanual pipeline welding:

1. Flash welding.
2. Carbon dioxide shielded-arc welding.
3. Induction-pressure welding.
4. Thermit welding.
5. High-temperature brazing.
6. Atomic hydrogen welding.

A few others have been investigated. But this list includes about all of the real possibilities. In making the welding process survey, the author has crossed the trails of several leading pipeline contractors who were independently investigating the subject.

Already the pipeline industry has tried out two nonmanual processes on a large scale—gas-pressure welding between 1941 and 1946 and automatic submerged-arc welding mostly in 1949 and 1950. Although both of them produced substantial results, they were dropped by contractors because of limitations.

Automatic submerged-arc welding—in addition to extensive yard operations—has been tried several times on the right-of-way for double jointing and for roll welding sections of several joints. But the difficulties of rotating the pipe on the right-of-way have been discouraging.

This article discusses possibilities and limitations of processes investigated in the survey. Information was obtained in the study the author was engaged to undertake as part of the Esso Research & Engineering Co. pipeline research program conducted under agreements it has with affiliated companies of Standard Oil Co. (N.J.), which have pipeline operations.

Maracaibo problem . . . Esso is much concerned with an unusual welding problem at Lake Maracaibo, in Venezuela, where Creole Petroleum Corp. double joints such a large amount of pipe every year that a flash-welding unit might be justified. For several years Creole has been flash welding boiler tubes and reinforcing rods.

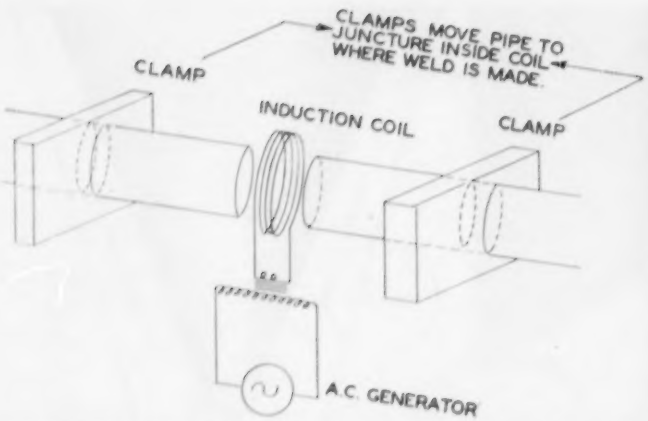
Upon the discovery that a carbon dioxide atmosphere is surprisingly good for shielding a consumable wire electrode for welding pipe in a fixed position, Esso turned its attention in this direction.

The carbon dioxide process seems to offer low investment, small power requirements, and easy application. It is a fast, simple, low-cost method. Attention was therefore switched from the highly perfected flash method with its high investment and high power requirements in favor of the partially developed carbon dioxide process.

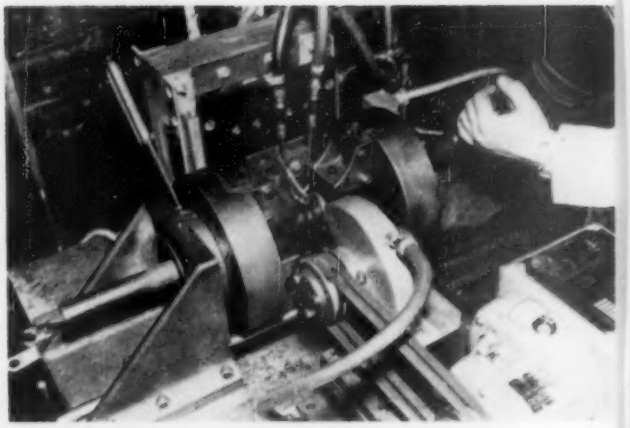
Thermit process . . . The thermit process might be adapted to pipeline welding. Thermit is a simple method that might be handy for making welds on small-diameter pipe with unskilled labor at certain times and places where electric-arc welding might not be available. Research might even develop a method for making the largest-diameter welds.

Two objectives . . . In looking for nonmanual welding processes which might be adapted to pipelining, two objectives are important: (1) speeding up the rate of progress of a pipeline spread; and (2) simplifying pipeline-welding operations. These two points seem more important than an effort to reduce welding costs alone without any other benefits to the spread. A process would be attractive if it promised to contribute to daily output of the spread as a whole.

The pipe gang is the bottleneck in the progress of a spread, even though pipe-gang operations are now highly perfected, and any increase in footage coming from a change in welding operations is likely to be profitable by giving the chance to speed up the other



INDUCTION-PRESSURE-WELD process being used to make girth welds. If the carbon dioxide process cannot be perfected, induction-pressure welding might be attractive for pipelining, especially for higher-tensile-strength pipe.



INDUCTION-PRESSURE WELDING of small-diameter pipe in a fabrication shop. So far only a few shops are using induction processes for girth welds.

operations. A great deal would be gained by completing the weld in one fast operation instead of in the four steps of stringer bead, hot pass, filler, and finish beads.

Flash Welding

Flash welding, a form of resistance welding, has attracted attention of pipeline engineers, particularly those who have seen flash welding of pipe seams at the A. O. Smith Corp. plant. A. O. Smith is the only pipe maker using flash welding for longitudinal welds.

Operation of flash welding is fast and simple although the process itself is not simple. Flash welding and broaching of small-diameter pipe have been done at the rate of more than a joint a minute.

In flash-welding, the two ends of the pipe are placed in an electric circuit adjacent to each other and an electric potential is applied. A current, strong enough to cause a flashing action, flows as the abutting pipe ends are brought closer together. When sufficient flashing has occurred to heat the metal to welding temperature, the weld is completed by applying upset pressure. During flashing and upsetting, metal is expelled from the joint.

You can order a flash unit today and it will be delivered at the end of the year. The process is highly developed and you can be sure of satisfactory results from flash-welding machines of a number of established manufacturers. Flash welding and submerged-arc welding are the only two automatic welding processes which are ready to go in the field for pipeline welding. However, both processes would be awkward to handle on a right-of-way.

Disadvantages . . . Makers of flash-welding units warn against two features of flash welding they believe will be objectionable for pipelining. One is the operation of removing the internal upset they call "flash," which consists of flaky and abrasive extruded vanes. Broaching for internal flash removal should be done immediately after welding while the metal is still hot. Broaching would be awkward on the right-of-way but it could be done in a yard operation. The external flash needs to be removed by grinding to prepare for coating application.

Large power requirements and the need for rigidity of the flash-welding unit call for costly heavy equipment which would be cumbersome to move over a rough right-of-way. Furthermore, such a unit would be restricted to operating in a limited diameter range. A yard unit for flash welding 4½ to 8½-in. pipe would cost $150,000 to $170,000 for welding, broaching, and pipe-handling equipment.

In addition, electric power would have to be furnished for a 1,200-kva. maximum upset demand. A single-phase diesel generator for this service would cost about $130,000. So the total investment could amount to $280,000 to $300,000. The welding and power equipment would weigh a total of 280,000 lb.

The unit could be operated by two or three men with an output of 10 to 30 welds an hour in diameters of 4½ to 8½ in.

Proposals for using preheating by induction to reduce the power requirements of flash-welding have not been considered advantageous by flash-welding engineers.

A mobile flash unit has been proposed using a large storage battery to reduce power requirements but it has not yet been built.

Carbon Dioxide Welding

In contrast with flash welding, the possibilities of the carbon dioxide-shielded welding-wire process seems much more attractive.

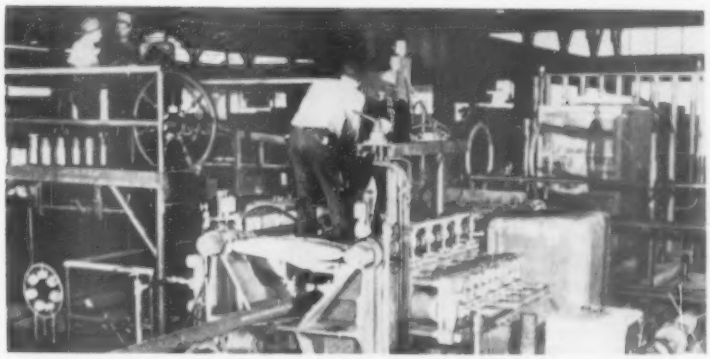
Main features were demonstrated in a similar process using inert gas (helium or argon) in the welding of aluminum pipe near Corpus Christi in 1953. But the welding of steel pipe is more difficult than that of aluminum pipe. And the problem of getting a good weld at the bottom of the pipe between the 5 and 7 o'clock positions has not yet been satisfactorily solved. But results are so encouraging that plans for a research program are now being considered for curing the defects in the carbon dioxide process.

The carbon dioxide process is an offshoot from the inert gas-shielded metallic-arc process.* Through patents and licensing rights this inert-gas process—but not the CO_2 process—is marketed for shop welding under trade names of Aircomatic, Sigma, and Fillerarc. Inert-arc welding, the most recent of the automatic-welding processes, has grown the fastest in the last 10 years.

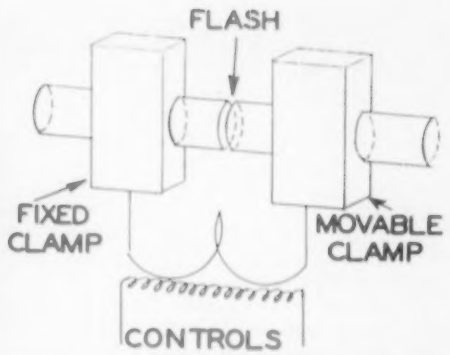
Carbon dioxide is better for welding steel pipe in a fixed position than argon or helium. It is much cheaper and easier to obtain. With carbon dioxide there is a shorter, hotter arc with deeper penetration which can be easily stabilized.

Apparatus rotates . . . The entire welding apparatus rotates on the pipe. Operation can be by push button. The operator needs no manual skill and he can learn how to run the machine in a few hours. If he is an experienced welder, he will naturally be a better operator. Furthermore, he can watch the weld being made and can correct for faulty operations. This is advantageous together with the fact that carbon di-

*Data for Fig. 2 were obtained from "Procedure Control as Applied to Automatic Welding Processes," by Walter H. Simon, presented at the American Welding Society spring meeting, Buffalo, May 4-7, 1954, and published in American Welding Journal, p. 1149, December 1954 issue.



FLASH-WELDING unit making girth welds at a steel mill. This indicates the large size of flash-welding equipment which is too bulky for pipelining on the right-of-way.



FLASH-WELDING diagram for making girth welds on pipe. Process is fast, cheap, and reliable but power requirements are high.

oxide welding is another form of the now familiar electric-arc-welding method. Therefore, it can be inspected by the same radiographic techniques now being used on pipelines.

The metal deposited has the same composition and structure as that of the manual process. The welding power supply required for this process is a standard 400-amp. d.c. welding motor generator set of the same type now used for pipeline construction.

With the carbon dioxide process, an 8-in.-diameter pipe with ¼ to ⅜-in. wall can be welded in a minute with one bead applied by a single arc. This includes removing the unit and going to the next weld.

Larger diameters . . . For larger diameters it is expected that more arcs could be added to keep welding time down to about a minute. Cost of materials for an 8-in. weld would be 1 cent for carbon dioxide and 5 to 6 cents for welding wire. Carbon dioxide could come in either liquid or cake form. Total cost of welding for an 8-in. weld would be 6 to 7 cents per weld for materials plus cost of labor, fuel, and equipment.

Laboratory tests made on welds produced by this method gave the following results:

Guided root and face bend tests were made through 180° without failure. In tensile tests (yield strength 44,700 psi. and tensile strength 69,600 psi.) the specimens broke outside the weld. Nick-break tests showed sound weld metal.

Macroexamination revealed incomplete root penetration and a trace of porosity. Weld reinforcement was nonuniform in depth, some areas being under flush and there was a general lack of penetration through the root of the joint. The mechanical properties of the weld, however, were satisfactory. And it is believed that the Aircomatic pipe welders can be developed to a point where satisfactory welds can be consistently made.

Until the carbon dioxide process for welding steel pipe blossomed rather suddenly about a year ago, it looked as though induction-pressure welding was the most promising possibility for nonmanual welding of pipelines. If the carbon dioxide process does not come up to expectations, interest may be revived in developing an induction-pressure-welding process.

Induction-pressure welding . . . Induction heating appears to have advantages over oxyacetylene-gas-flame heating for pressure welding because induction heat can be applied more uniformly and more accurately. There are also two other pressure-weld processes — flash and rotating arc.

Gas-pressure-welding process . . . This process was developed by El Paso Natural Gas Co. and Linde Air Products Co. under the direction of A. L. Forbes, former president of the Pipeline Contractors' Association. Gas-pressure welding demonstrated what could be accomplished by making pipeline welds with heat and pressure.

From 1941 through 1946 more than 1,000 miles of pipe was gas-pressure welded. Difficulties experienced in most cases could be traced to irregularities due to small details, which might have been corrected by a development program. Much policing was needed to insure that pipe ends were properly cleaned before welding.

In spite of much serious trouble on some projects, gas-pressure-welded pipe continues to give good service. During World War II the Bureau of Mines specified that it be used entirely for making the welds on the helium line in the Texas Panhandle because it would be the tightest. This was necessary because helium leaks three times as fast as natural gas.

Induction heating . . . For making a fresh start to develop a pressure-welding method for pipelines, it now seems more attractive to use induction heating than gas heating. Great improvements have been made in the last 15 years in induction-heating techniques widely used for hard surfacing and stress relieving. Induction welding is still in the early stages of development.

A more uniform and more accurately controlled heat can be applied by induction heating than by a gas flame. Heat applied by an induction coil does not vary in the way that a gas flame will as a result of the irregularities in the burners and in the supply of gas, also from the effect of the wind and from errors in judgment of the operators.

On the other hand, the gas flame had the advantage of protecting the weld against oxidation. Protection against oxidation is a vital problem of the induction method.

A few large fabrication shops are welding piping by separate induction-pressure-welding processes developed independently for their own use to supplant flash and gas-pressure-welding procedures. For the best results there should be some rotation of either the coil or the pipe. A fairly slow movement of the coil for 90 to 180° around part of the pipe in a fixed position would be practicable to handle.

Difficulties with oxidation have been overcome in some shops by an inert-gas atmosphere. In another type of shop oxidation was avoided by trimming the two ends of the pipe with a special milling cutter immediately before induction-pressure welding. After cutting, the fresh clean surfaces are immediately butted together for induction heating before oxidation can occur. In this shop no inert gas is used with induction welding.

High pressures . . . Induction welding is done by high pressures (7,000 to 10,000 psi.) and lower-than-fusion temperatures (1,800° to 1,900° F.). Induction allows the heat to be concentrated entirely at the butt joint, thus

eliminating deformation of adjacent sections or change of metallurgical properties. The induction coil remains cool while heat is induced in the pipe.

Induction heating depends on conversion of electric power into high-frequency power. Basic elements are capacitors for storing electrical energy electrostatically and inductors for storing it electromagnetically. The energy so stored can be caused to surge to and fro between capacitor and inductor to produce high-frequency and electrostatic fields of sufficient intensity to produce useful heating effects.

An effort to develop an induction-pressure-welding process for pipelining resulted in a research program carried on for several months in the shop of one of the largest manufacturers of induction-heating equipment.

For welding 30-in. pipe, a 400-hp. welding unit would cost $100,000 to $150,000. The largest part of the unit would be the mobile power plant, weighing 14 to 18 tons. A complete pressure weld would be made in 30 seconds. The entire operation of line-up and welding would be about 2 to 3 minutes. Operating personnel would be a "run-of-the-mine" electrician and one or two helpers and a tractor driver.

Power would be 60-cycle, 220-240-volt, 3-phase. Frequency for induction welding would be between 1,000 and 3,000 cycles.

Induction-welding costs have been estimated at between $14 and $16 per weld for 30-in.-diameter pipe with ⅜-in. wall. These costs include labor, fuel, and amortization of a $150,000 unit. A special external hydraulic clamp would be desirable for insuring close lineup.

If induction welding were used on pipe lines, the advantage of this process would increase progressively for the larger diameters as it would with other nonmanual processes. For no more time would be taken in making a large-diameter weld than in a small-diameter.

Automatic submerged-arc welding . . . This is so familiar to the pipeline-construction industry that it can be briefly summarized. Since it requires rotation of the pipe, it has been applied at yards almost entirely. At such yards it has been customary to run stringer beads by manual electric-arc welding and complete with automatic welding.

Following its biggest use in the 1949-1950 period, it has declined so that now only one contractor has been operating such an automatic yard in the past year. The only completely automatic operations for running all beads by submerged arc was in 1949 and 150 at Ras el Mishaab in Saudi Arabia and at a pipe mill in California.

After several attempts to apply submerged arc welding on the right-of-way, nothing has been reported for such operations in the last 3 years. The bulkiness of the equipment and the difficulty of rotating the pipe in a horizontal position have discouraged further efforts on the right-of-way.

Thermit welding . . . This, one of welding's oldest processes, was invented in 1895. Since then thermit has been largely used for welding street-car rails. The thermit material is a mechanical mixture of finely divided metallic aluminum and metallurgically processed iron oxide. To this simple mixture are added manganese and carbon and sometimes such elements as nickel, molybdenum, chromium, and vanadium. Materials come packaged from the manufacturer.

When it is fired by ignition powder, producing a temperature of 2,800° F. a vigorous reaction takes place. Aluminum combines with oxygen of the iron oxide becoming aluminum oxide, leaving metallic iron or more properly steel. The reaction takes 30 seconds and produces a temperature of 5,000° F. The steel formed is highly liquid and separates from the aluminum oxide which floats to the top of the mold as slag.

Inexperienced labor can be quickly taught to make thermit welds.

Thermit has been used exclusively on the stern frames of ships. Two large hotels in Chicago had all of their piping welded by thermit. Currently, in some parts of the country, it is the most economical method for welding reinforcing rods for concrete construction.

Thermit makes a strong weld quickly and simply. The drawbacks have been the handling of molds and removal of weld buildup In commercial applications, thermit has not yet been practicable for welding pipe larger than 4-in. diameter.

If improvements can be made in molds and practices for more efficient application of thermit and for the reduction of the size of the upset, the process will be more usable for pipe welding.

Thermit may be a handy process to use for gathering-line construction, particularly in foreign operations when electric-arc welding may not be available. There may be cases in pipeline construction when welders may not be available for completing a last short stretch of a fairly big job. A simple welding method not requiring manual skill might be advantageous.

Furthermore, in the future when the pipeline industry considers using pipe of higher carbon steel which might be difficult to weld with electric-arc welding, a thermit-welding process may be convenient for making tiein welds. Perhaps at that time, a revival or a new development of a pressure welding process might be more economical for the principal welding operations of a main-line spread laying higher-carbon-steel pipe.

Thermit is regarded as the most adaptable for the varying conditions of chemistry at the ends of the pipe.

On some types of jobs thermit may be cheaper. But even though it may be discovered that it costs more, there may be advantages in having available an alternative welding technique—another method—when electric arc welding is not available.

High-temperature brazing is a novel process with interesting speculative possibilities which has been proposed for consideration in pipeline construction.

The technique makes strong welds for crankshafts and condenser tubing. But it does not have sufficient ductility to meet the severe 180° reverse root-bend test of the pipeline welding code. Efforts are being made to get an alloy which will meet the code standards for pipeline welding.

The alloy used contains no copper. This braze is regarded as a thoroughly sound welding method and is regularly used to meet exacting conditions in the building of big steam turbines, jet engines, and nuclear reaction equipment.

The high-temperature brazing technique is basically simple and can be applied by unskilled labor which can be trained in a few days.

Atomic hydrogen welding is successfully used in welding transmission housings for trucks and cranes. It makes a thoroughly sound weld but is not simple. No manual skill is required but considerable experience is required.

Atomic hydrogen welding is an arc-welding process in which coalescence is produced by heating with an electric arc maintained between two metal electrodes in an atmosphere of hydrogen. No filler metal is needed. The joint is formed by fusing the pipe edges together as they are held under pressure. Pressure is applied at 10,000 psi. Pipe could be welded in half a minute.

To develop a unit for pipelining would take 2 years. The welding unit alone not including electric-generating equipment would cost close to $50,000.

Conclusions

When the welding survey started, the author was instructed to "try to find a zipper or some way of sticking pipe together and gluing it."

The carbon dioxide process looks like a good zipper. Further in the distance, induction-pressure welding, thermit welding, and high-temperature brazing look like possible gluing methods. Perhaps a new method may come which would combine several processes.

Hydrogen Treatment Improves Fuel Oils

New Gulf process upgrades the quality of distillates, improving performance in heating equipment, and removes much of the sulfur

by R. P. Gilmartin,* W. A. Horne,† and B. R. Walsh†

USE of a hydrogenation process in the manufacture of No. 2 fuel oils offers an attractive method for upgrading the quality of these fuels and improving their performance in heating-oil equipment.

A substantial reduction in sulfur content results. This is significant with respect to reduction in ring wear and deposits where these fuels are employed in diesel engines.

The hydrogen-treating process developed by Gulf is called Gulfining. This process involves reacting hydrogen with fuel-oil distillate streams in the presence of a catalyst, at elevated temperature and pressure.

Stock inspections . . . Table 1 lists inspections of a doctor-sweetened West Texas straightrun No. 2 fuel-oil distillate and a hydrogen-treated West Texas straightrun No. 2 fuel-oil distillate. Doctor sweetening of certain fuel-oil distillate streams has been employed for some years to improve odor by conversion of objectionable-smelling sulfur compounds in sour distillate.

Hydrogen treatment eliminates the need for doctor sweetening.

Table 2 shows similar data on a fluid-catalytic-cracked No. 2 fuel-oil distillate. Table 3 lists data on a blend of distillates before and after hydrogen treatment. These data were obtained on fuels from pilot-plant studies. Commercial-scale hydrogenation units for such treatment are now under construction at Gulf's Port Arthur refinery.

These data show that hydrogenation has significantly changed the pertinent fuel-oil properties.

Sulfur content . . . This processing with hydrogen results in 80-90 per cent desulfurization of either virgin or catalytic cracked No. 2 fuel-oil distillates. This includes essentially complete removal of mercaptan sulfur compounds, which, if not removed, give an objectionable odor to the fuel.

Present practice relies on doctor sweetening or other chemical treating processes to improve odor with little or no reduction in sulfur content. Some of these treatments have a deleterious effect on storage stability and fuel compatibility.

Carbon residue . . . The carbon residue on 10 per cent bottoms is decreased substantially by hydrogen treatment. For example, values ranging from 0.15 to 0.50 per cent for cracked distillates are reduced by hydrogenation to 0.02 to 0.05 per cent, or a lowering of approximately 80-90 per cent. Reductions are also obtained with virgin distillates; however, the carbon-residue values of these distillates are usually low before hydrogenation.

Blends of cracked and uncracked distillates frequently have higher carbon residues on 10 per cent bottoms than either component. Hydrogenation will also lower the carbon residue on such blends to less than 0.05 per cent.

Color . . . The charge to the hydrogen-treating units is normally fresh or unaged No. 2 fuel oil, in which case the color of the treated product is the same or only slightly lighter than that of the charge to the units. However, any fuel which has darkened in extended storage can be satisfactorily hydrogen treated to produce a product with a color equal to that of the product processed from unaged stock.

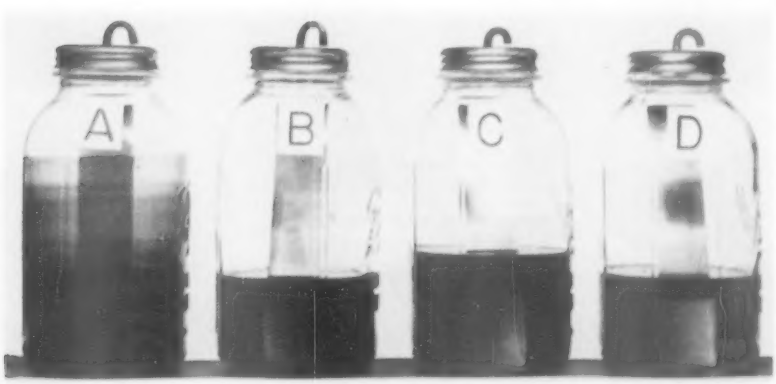
The most important point is that very marked improvements in color stability during long-time storage are obtained whether the distillates are unaged or aged before hydrogenation. In some cases, hydrogen-treated fuels are more color stable than straightrun No. 2 fuel oils.

A.P.I. gravity . . . About a 3.0° A.P.I. gravity increase is obtained on hydrogenation of catalytic cracked distillates and about 1.0° or less for virgin straightrun distillate. The commercial No. 2 fuel oils are raised approximately 1.0° to 2.0° in A.P.I. gravity, depending upon the amount of hydrogen treated catalytic cracked distillate present.

There is no major change in the hydrocarbon composition by hydrogen treatment. Some of the more reactive unsaturated hydrocarbons such as olefins are converted to saturated hydrocarbons, and, in addition, the reactive sulfur, nitrogen, and oxygen compounds are removed. The aromatics are only slightly reduced.

Practically all acids such as naphthenic acids are removed by hydrogen treatment. Untreated distillates may have neutralization numbers in the range of 0.04 to 0.10 and these are reduced to less than 0.01.

*Gulf Oil Corp., Pittsburgh, and †Gulf Research & Development Co., Harmarville, Pa. Paper presented at A.S.M.E. annual meeting, Chicago, November 1955.



SLUDGE STABILITY . . . After 6 months' storage under simulated tank storage conditions: "A" is untreated cat cracked fuel—poor color and heavy sludge; "B" is blend of hydrogen-treated cat cracked and straightrun No. 2 fuel-oil distillate—better color and less sludge; "C" is same as "B" but with stabilizing agent—no obvious improvement over "B"; "D" is blend of hydrogen-treated cat cracked and hydrogen-treated straightrun—has best color and no indication of sludge. Fig. 1.

Sludge Stability

One of the most significant benefits derived from hydrogen treatment is improvement in the resistance to formation of sludge in storage. Table 4 shows the storage test data on fuels before and after hydrogen treatment. These data show that sediment or sludging properties, as well as color stability and carbon residue on 10 per cent bottoms, are improved considerably. Fig. 1 is a photograph taken after sample storage for 6 months. The samples were stored in the dark at room temperature in vented 2-qt. bottles containing a steel strip. This procedure simulates conditions in customer tanks. Portions of the samples are taken at intervals for examination.

The photograph shows that:

1. **Sample A,** an untreated catalytic cracked fuel, has a poor color and contains heavy sludge as evidenced by the deposits on the wall of the container.

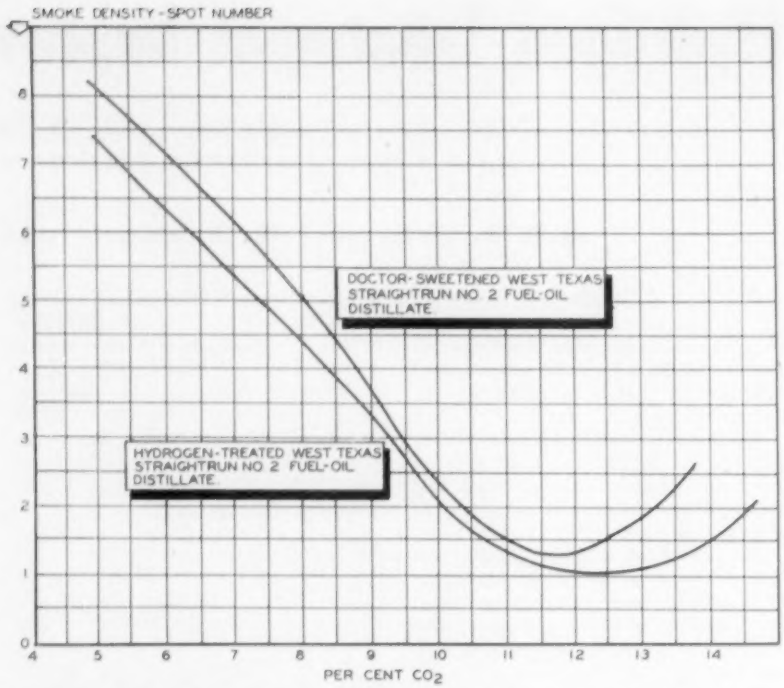
2. **Sample B,** a commercial blend of equal amounts of hydrogen-treated catalytic cracked and doctor-sweetened West Texas straightrun No. 2 fuel-oil distillate, has a better color than Sample A and also contains less sludge.

3. **Sample C,** the same fuel as Sample B except that it contains a commercial stabilizing agent, is about the same as Sample B, no obvious improvement.

4. **Sample D,** a commercial blend of equal amounts of hydrogen-treated catalytic cracked and hydrogen-treated West Texas straightrun, has the best color with no indication of sludge.

In addition to long-time storage tests, accelerated stability tests were run. This test involves heating the fuel sample at 210° F. for 16 hours and measuring sludge formation or sediment. Tests of this type are used rather extensively in the petroleum industry as a laboratory control method in the manufacture of stable No. 2 fuel oils.

Table 5 shows results of accelerated stability tests on both untreated and hydrogen-treated fuels. Accelerated tests have also been conducted for 48 and 64 hours' duration, and the hydrogen-treated samples in all cases show marked improvement analogous to that found after 16 hours.


SMOKE DENSITY - SPOT NUMBER
DOCTOR-SWEETENED WEST TEXAS STRAIGHTRUN NO. 2 FUEL-OIL DISTILLATE
HYDROGEN-TREATED WEST TEXAS STRAIGHTRUN NO. 2 FUEL-OIL DISTILLATE
PER CENT CO_2

SMOKE DENSITY VS. FLUE-GAS CO_2 . . . Tests conducted in rotary-wall flame burner with untreated and hydrogen-treated fuels. Fig. 2.

Effect of sulfur . . . Johnson, Fink, and Nixon reported[1] that certain types of sulfur compounds contribute more than others to instability of fuel oil in storage. Polysulfides, high-molecular-weight mercaptans, and thiophenols appear to promote instability and sludge formation.

These compounds should be among those most easily destroyed by hydrogen treatment. The quantity of the mercaptan sulfur content of hydrogen-

TABLE 1—FUEL-OIL PROPERTIES

Description—	Doctor-sweetened West Texas straightrun No. 2 fuel oil	Hydrogen-treated West Texas straightrun No. 2 fuel oil
Inspection:		
Gravity, °A.P.I.	39.6	40.3
Viscosity, S.U.s. at 100° F.	32.3	32.5
Flash, P.-M., °F.	164	162
Color, A.S.T.M. union	1½	7
Odor	Fair	Good
Sulfur, per cent	0.71	0.11
Carbon residue on 10 per cent bottoms, per cent	0.17	0.01
Aniline point, °F. (A.S.T.M. D-611-1-53T)	141	146
Cetane number	46.4	47.5
Neutralization number	0.01	0.01
Distillation, gas oil (A.S.T.M. D-158-54):		
I.b.p., °F.	373	371
End point, °F.	569	570
10 per cent point at °F.	407	405
50 per cent point at °F.	448	447
90 per cent point at °F.	512	513
Hydrocarbon type, F.I.A., per cent by volume:		
Aromatics	21.5	20.0
Olefins	3.0	2.0
Saturates	75.5	78.0

TABLE 2—FUEL-OIL PROPERTIES

Description—	Fluid catalytic cracked No. 2 fuel oil	Hydrogen-treated fluid catalytic cracked No. 2 fuel oil
Inspection:		
Gravity, °A.P.I.	22.6	26.0
Viscosity, S.U.s. at 100° F.	36.5	35.4
Flash, P.-M., °F.	208	184
Color, A.S.T.M. union	2—	1—
Odor	Poor	Good
Sulfur, per cent	2.10	0.36
Carbon residue on 10 per cent bottoms, per cent	0.23	0.04
Aniline point, °F. (A.S.T.M. D-611-1-53T)	84	88
Cetane number	24.5	27.1
Neutralization number	0.05	0.01
Distillation, gas oil (A.S.T.M. D-158-54):		
I.b.p., °F.	425	388
End point, °F.	645	640
10 per cent point at °F.	469	449
50 per cent point at °F.	535	524
90 per cent point at °F.	609	607
Hydrocarbon type, F.I.A., per cent by volume:		
Aromatics	62.2	61.6
Olefins	10.1	3.2
Saturates	27.7	35.2

TABLE 3—FUEL-OIL PROPERTIES

Description—	70 per cent Kuwait straightrun 30 per cent fluid catalytic cracked	70 per cent Kuwait straightrun hydrogen-treated 30 per cent fluid catalytic cracked hydrogen treated
Inspection:		
Gravity, °A.P.I.	33.6	35.7
Viscosity, S.U.s., at 100° F.	35.2	35.1
Flash, P.-M., °F.	176	174
Color, A.S.T.M. union	3	2—
Odor	Fair	Good
Sulfur, per cent	1.47	0.18
Carbon residue on 10 per cent bottoms, per cent	0.21	0.03
Aniline point, °F. (A.S.T.M. D-611-1-53T)	136	141
Cetane number	48.0	48.0
Neutralization number	0.04	0.01
Distillation, gas oil (A.S.T.M. D-158-54):		
I.b.p., °F.	391	378
End point, °F.	639	640
10 per cent point at °F.	437	438
50 per cent point at °F.	516	508
90 per cent point at °F.	605	599
Hydrocarbon type, F.I.A., per cent by volume:		
Aromatics	29.4	30.4
Olefins	9.6	5.5
Saturates	61.0	64.1

treated fuels is reduced to 0.001 per cent or less, regardless of the initial content.

Thompson, Chenicek et al. have reported[2] that the addition of certain nitrogen compounds to fuel oils has been found to contribute to instability of fuel oil in storage. Laboratory examination of sludge samples obtained from No. 2 fuel oils showed nitrogen compounds concentrated in the sludge.

These observations lead to the conclusion that the removal of reactive nitrogen compounds from the fuel, by hydrogenation, contributes to improve storage stability.

At the present time most commercially available No. 2 fuel oils are treated with agents to improve stability against sludge formation in storage. Hydrogen treatment eliminates the need for employing these agents.

Table 6 shows laboratory storage and accelerated stability test data on an un-

TABLE 5—ACCELERATED STABILITY TEST DATA

Sample—	Stability test run at 210° F., 16 hours: Insoluble sludge (mg./600 g.)	Color, A.S.T.M. union: Before	After
Unsweetened West Texas straightrun No. 2 fuel-oil distillate	4.1	1—	1½—
Hydrogen-treated West Texas straightrun No. 2 fuel-oil distillate	0.4	1—	1—
Untreated F.C.C. No. 2 fuel-oil distillate	4.2	2	4½—
Hydrogen-treated F.C.C. No 2 fuel-oil distillate	1.0	2—	2½—
Untreated Kuwait straightrun No. 2 fuel-oil distillate	0.5	1—	1—
Hydrogen-treated Kuwait straightrun No. 2 fuel-oil distillate	0.5	1—	1—

TABLE 4—STORAGE STABILITY OF DISTILLATE OILS AND BLENDS

Sample—	Storage (mos.)	Color A.S.T.M. union	Sediment (mg./100 ml.)	Carbon residue Conradson on 10% bottoms (%)
Unsweetened West Texas straightrun No. 2 fuel-oil distillate	0	1	0.7	0.02
	6	1½—	5.3	0.12
Hydrogen-treated West Texas straightrun No. 2 fuel-oil distillate	0	1—	0.1	0.01
	6	1—	0.1	0.01
Blend: 51 per cent hydrogen-treated F.C.C. No. 2 fuel-oil distillate plus 49 per cent hydrogen-treated West Texas straightrun No. 2 fuel-oil distillate	0	2—	0.8	0.04
	6	2½—	1.7	0.04
Blend: 51 per cent hydrogen-treated F.C.C. No. 2 fuel-oil distillate plus 49 per cent doctor-sweetened West Texas straightrun No. 2 fuel-oil distillate	0	2—	1.0	0.15
	6	3—	2.3	0.19
Untreated F.C.C. No. 2 fuel-oil distillate	0	2	0.2	0.36
	6	6—	13.7	0.56
Hydrogen-treated F.C.C. No. 2 fuel-oil distillate	0	2—	0.2	0.05
	6	3—	0.5	...
Untreated Kuwait straightrun No. 2 fuel-oil distillate	0	1—	0.3	0.03
	6	1—	1.2	...
Hydrogen-treated Kuwait straightrun No. 2 fuel-oil distillate	0	1—	0.1	0.02
	6	1—	0.3	...

TABLE 6—STORAGE AND ACCELERATED STABILITY DATA ON BLENDS OF NO. 2 FUEL-OIL DISTILLATES

Description—	Untreated blend without stabilizing agent	Untreated blend with stabilizing agent	Hydrogen treated blend without agent
Sample makeup, per cent by volume:			
Doctor sweetened West Texas straightrun No. 2 fuel-oil distillate	35	35	
Untreated F.C.C. No. 2 fuel-oil distillate	65	65	
Hydrogen-treated West Texas straightrun No. 2 fuel-oil distillate			35
Hydrogen-treated F.C.C. No. 2 fuel-oil distillate			65
Stabilizing agent, per cent by volume		0.06	...
Laboratory inspections:			
Color, A.S.T.M. union	2—	2—	1½—
Accelerated stability test method, 210° F.:			
Potential insolubles, mg./600 g.:			
At 16 hours	58	6	1
At 40 hours	81	79	2
At 64 hours	142	99	2
Color, A.S.T.M. union (filtrate):			
At 16 hours	6—	5—	2—
At 40 hours	7—	8	3—
At 64 hours	8—	8	3½—
Laboratory storage stability test:			
Room temperature:			
Insoluble matter, mg./100 ml.:			
At 12 weeks	3.0	1.4	0.5
Color, A.S.T.M. union:			
At 12 weeks	4—	4—	2—

treated fuel, a fuel containing a commercial stabilizing agent, and a hydrogen-treated fuel without stabilizing agent. These data, together with similar data on other commercial stabilizing agents, indicate that hydrogenation is most effective in upgrading the storage stability of No. 2 fuel oil.

Water separation . . . Water contamination in shipping and storage of distillate fuel oils is almost unavoidable. No. 2 fuel oils vary widely in water-separation properties. Hydrogen-treated fuel oils show good water-separation characteristics, comparable to a superior virgin straightrun distillate.

Some commercially available stabilizing agents, when added to the fuel, make water separation more difficult. In contrast, hydrogenated fuel does not require stabilizing agents, and thus has better water-separation characteristics.

Burner Performance

Since fuel-oil stability is improved by hydrogenation, improvement of the performance in domestic burners should be expected. Before combustion in the burner, the fuel must flow properly through the burner piping system, control mechanisms, filters, and the fuel atomizing or distributor assembly.

Hydrogen-treated fuels, being stable against sludging, have shown no tendency to clog filters or strainers and small orifices in burners.

In addition, brass and copper parts of domestic oil burners should be unaffected as a result of the improved antisludging properties; lower sulfur, oxygen, and nitrogen contents; and better water-separating characteristics of the hydrogen-treated fuels.

Fig. 2 shows the results of 1-day tests in which smoke density is plotted against per cent CO_2 in the flue gas. These tests, conducted in a rotary wall flame burner on an untreated and a hydrogen-treated fuel, show a slight reduction in smoke density with the treated fuel.

In installations where the air adjustment is not positioned properly for low smoke density, the substitution of the hydrogen-treated fuel for the untreated fuel would likely convert a borderline operation to a satisfactory condition. Fig. 2 shows that the CO_2 operating range for a fixed smoke density has been increased with the treated fuel; for example, about 2 per cent CO_2 at a No. 2 smoke density reading.

A comparison test on deposits run in a rotary burner for 70 hours showed that the hydrogen-treated fuel reduced the volume of deposits by 11.0 per cent. In the tests on the two fuels, the burner was operated 10 days using a 20-minute "on" 10-minute "off" cycle for 7 hours each day.

This reduction in deposits was confirmed by 5-day tests conducted on No. 2 fuel oils in a pot-type burner. An 11 per cent reduction in deposits could result in less servicing for installations troubled by excessive deposits.

Acknowledgment

The technical assistance of various members of the staff of Gulf Research & Development Co. and of the technical division of the manufacturing department, Gulf Oil Corp., is greatly appreciated by the authors.

References

1. C. R. Johnson, D. F. Fink, and A. C. Nixon, Ind. Eng. Chem., 46, 2166 (1954).
2. R. B. Thompson, J. A. Chenicek, L. W. Druze, and Ted Lymon, Ind. Eng. Chem., 43, 935 (1951).

Skid-Mounted Engine Compressors Speed Up Gas Marketing

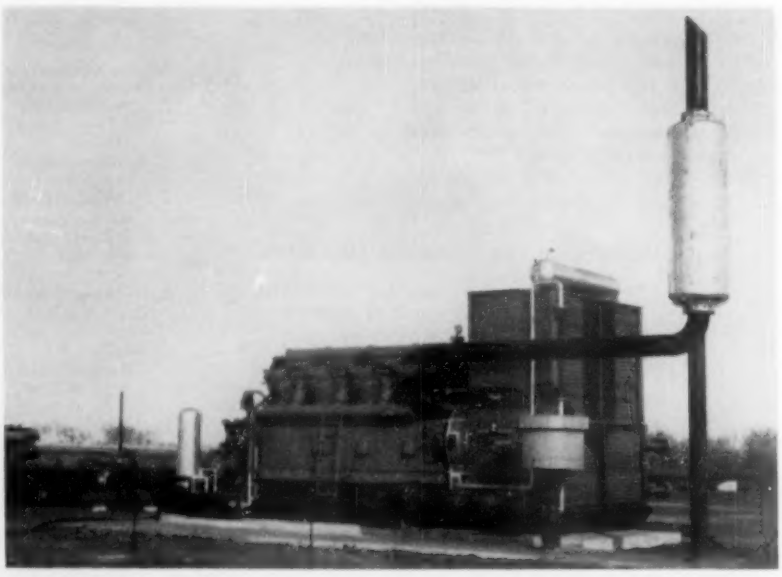
EARLY marketing of gas during the development of Short Junction field *(see The Oil and Gas Journal, December 12, 1955, page 82, "Acid Fracturing Puts This Field in the Black)*, 8 miles southwest of Oklahoma City, will be accomplished with skid-mounted engine compressors. Continental Oil Co., as major producer in the field, has installed a gas-gathering system with a daily capacity of 100 million cubic feet and one 550-hp. skid-mounted engine compressor with a daily capacity of 4 million cubic feet.

Additional engine compressors will be installed as they are required. Boosted gas from the compressor station is under contract to Oklahoma Resources Development Co.

Production of Short Junction field is from the Hunton lime formation, which is noted for increasingly high gas-oil ratios. Estimates indicate that as much as one-third of the revenue from production may be from the sales of gas. To obtain as much of this revenue as possible, design and construction of facilities for gathering and boosting the gas were commenced with development of the field.

The gathering system was installed for the maximum gas production anticipated while the compressor facilities were installed for only the present gas production. Additional development of the field and increasing gas-oil ratios may require the installation of 15 to 25 additional skid-mounted engine compressors.

By the installation of skid-mounted engine compressors, the investment in compressor facilities will be delayed until actual gas production justifies their installation — while the gas produced during the development of the field will be marketed.



SKID-MOUNTED engine compressors with daily capacity of 4 million cubic feet are used to help in early marketing of gas by Continental Oil Co. during development of Oklahoma's Short Junction field.

How Basic Electric-Log Curves Function

by Robert V. West, Jr.
Slick Secondary Recovery Corp.

This series of logging articles explains present techniques and recent developments in well logging in a summarized form. It may serve both those wanting a ready reference or those wanting to familiarize themselves with well logging.

PART 1 of this series of articles explained how the spontaneous potential or S. P. curve originates. It has been shown that the S. P. is a function of the sum of both electrochemical and electrokinetic potentials both in the formation and in the bore hole near a shale and a nonshale permeable zone. This second part further describes the factors affecting the S. P. and also explains the origin and nature of conventional resistivity curves.

Factors Affecting the S.P.

Differential pressure across the mud cake at the permeable zone . . . Equation 2 ($E_s = kP^3$) shows that the electrokinetic component of the S.P. voltage increases with an increase in the pressure differential across the mud cake. Large pressure differentials prevail where low-pressure sands are drilled or where heavy mud is used. Conversely the electrokinetic component decreases with decreasing pressure differentials, becoming zero at zero pressure differential. In most cases the electrokinetic component of the S.P. voltage appears to have limited importance.

Thickness of permeable zone . . . For thin zones the maximum S.P. amplitude decreases as the zones become thinner. As the deflection decreases, the curve becomes more rounded. This effect is illustrated in Fig. 5 where S.P. deflections for several sands are shown as a function of sand thickness. Sand conditions are assumed to be identical so that any decrease in S.P. amplitude is the sole result of sand thinning. This thinning limitation of S.P. deflection prevails only in cases where the sand thickness is less than twice the hole diameter.

Depth of penetration of mud filtrate into permeable zone . . . Mud-filtrate invasion into a permeable zone laterally extends drill-hole fluid conditions into the zone and effectively increases the drill-hole diameter. The result of this situation is to decrease the ratio of zone thickness to hole diameter. This effect limits the amplitude and increases the roundness of the S.P. curve. Fig. 6 illustrates this effect.

Shale content of permeable zone . . . For fixed conditions of sand thickness and fluid saturation the maximum S.P. amplitude occurs for clean permeable sands, decreasing with increasing amounts of shale. This effect is illustrated in Fig. 7. In shaly sands the S.P. deflection is further decreased at zones containing oil. Hence, in such sands a change in S.P. deflection occurs at the oil-water contact. This effect, shown in Fig. 8, occurs only in thin, shaly sands, and is often helpful in checking oil-water contact planes determined by other measurements.

Frequently there is some uncertainty concerning the exact top of a permeable formation. Often the top is arbitrarily picked midway between the

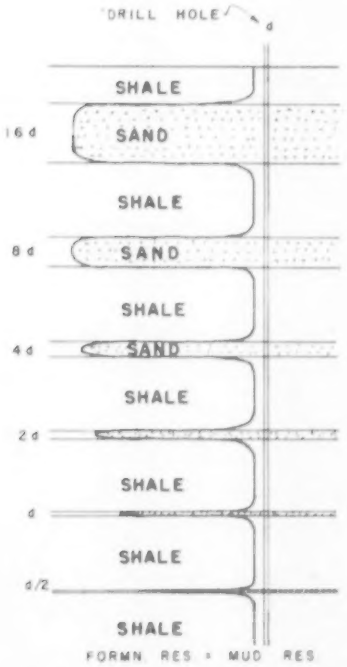


Fig. 5—Decreasing sand thickness causes rounding of the S. P. curve and a reduction in amplitude.

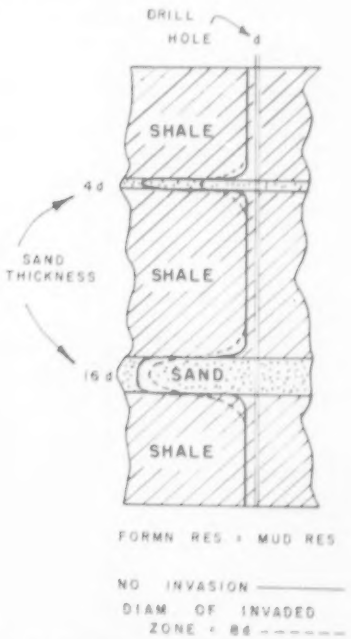


Fig. 6—Invasion of mud filtrate decreases S. P. deflection much the same way as an enlarged bore hole.

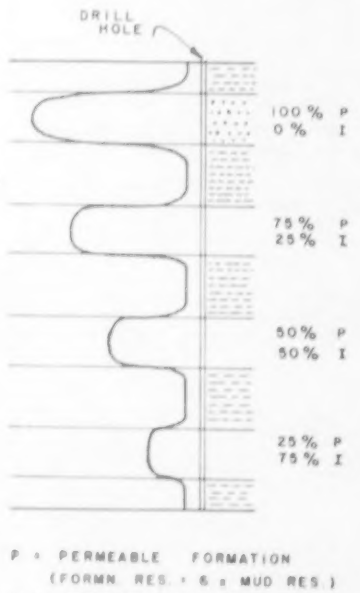


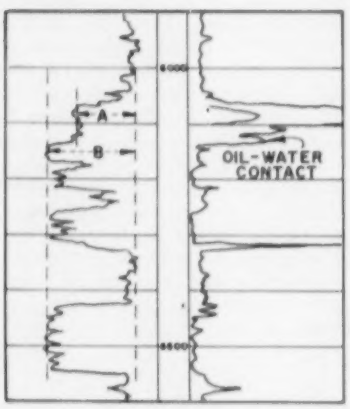
Fig. 7—Increasing amounts of shale in permeable formations reduces S. P. deflection.

start of the S.P. deflection and the point of maximum amplitude. Actually, the contact plane between beds of different lithology corresponds to the inflection point on the S.P. curve.

The above discussions refer to S.P. logs for sand formations. Permeable zones of hard formations such as limestones and dolomites behave similarly to sands.

Resistivity Curves: General Information

Resistivity curves are recorded on the right-hand track of electric logs. The two basic curves are known as the normal and the lateral. These curves exhibit different characteristics because they are recorded with different electrode arrangements. In early logging terminology the S.P. curve was called the first curve, the normal resistivity curve recorded with a short electrode spacing the second curve, the normal resistivity curve recorded with a longer electrode spacing the third curve, and the lateral resistivity curve the fourth curve. The significance of electrode spacing and the difference between normal and lateral electrode arrangements will be explained later.



A = PSEUDOSTATIC S.P. OF OIL SAND
B = PSEUDOSTATIC S.P. OF WATER SAND

Fig. 8—A change in S. P. deflection may occur at oil-water contact in thin, shaly sands.

Several other formation - resistivity measurements are made and are represented by such curves as the limestone curve, the Laterolog, the MicroLog, and the Microlaterolog; however, each of these types is a variation of the two basic resistivity curves. Where a nonconductive drilling fluid fills the hole, formation resistivities cannot be measured in the conventional manner. In such cases resistivities may be measured by induction-logging techniques. Induction logs are often run in conjunction with gamma-ray surveys. They will be discussed later and are mentioned here only because they are resistivity-log substitutes.

... **General principles** of formation-resistivity measurement can be visualized by reference to Fig. 9. In this figure A is a point electrode lowered into a hole penetrating a homogeneous formation. The formation resistivity is assumed equal to that of the bore-hole fluid. A is connected through an insulated cable to one pole of an electric-power source, either pulsating d.c. or low-frequency a.c. The other pole of the power source is connected through a second insulated cable to electrode B at a considerable distance from A. An electric current flows from A to B through the hole and the formation, which complete the electric circuit. Since the formation is homogeneous and has a resistivity equal to that of the bore-hole fluid, the resistance to current flow is the same in all directions, and equipotential surfaces are concentric spheres about A. The dotted lines of Fig. 9 represent the current lines, and the solid circles cross-sections through spheres of equal voltage.

Fig. 10 shows conditions similar to those of Fig. 9 except a boundary is

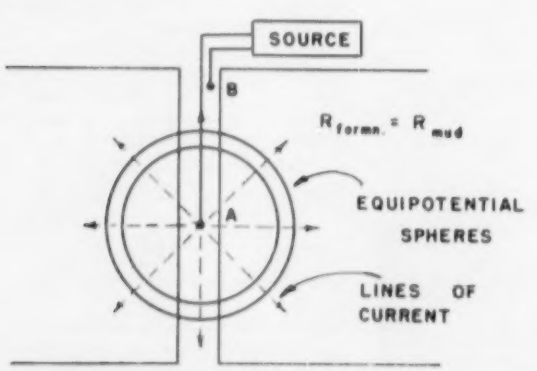


Fig. 9—Spherical potential distribution in a homogeneous formation around the current electrode of a formation-resistivity measuring system.

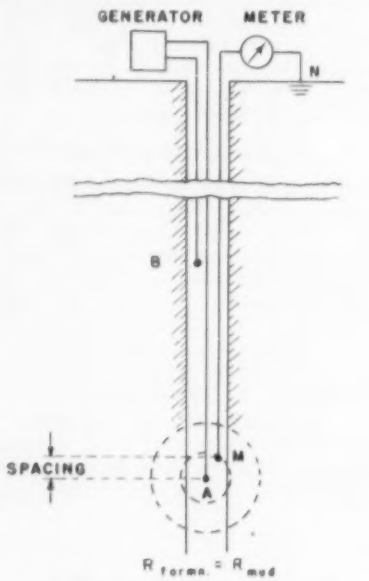


Fig. 11—Electrode arrangement used to record normal curves. A is current electrode, M is voltage-measuring electrode.

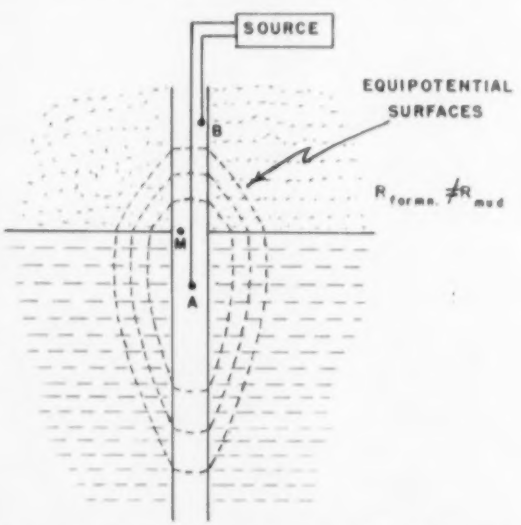


Fig. 10—How the potential envelopes change near the boundary of two formations of different resistivity. Voltages existing at M are a function of resistivities of the formations.

THE AUTHOR

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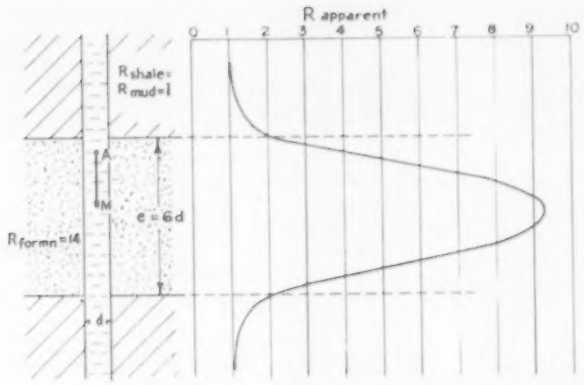


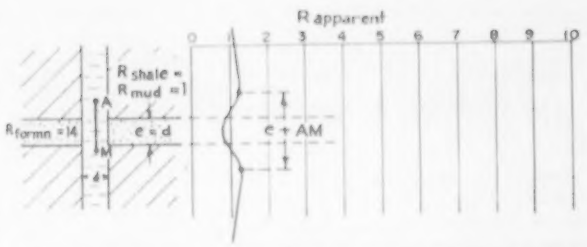


Fig. 12a. (left)—In a homogeneous formation bounded by thick zones of equal resistivity, the normal curve is symmetrical. Fig. 12b. (above)—When thinner than electrode spacing, the high-resistivity formation is recorded as having a lower resistivity than the bounding shale. Thin-sand humps occur on each side.

interposed between two formations of different resistivities. The lower formation is more resistive than the upper, and the resistivity of both formations is greater than that of the mud. The current lines from A are no longer straight, and the surfaces of equal potential about A are no longer concentric spheres. The current flows more readily in the low-resistivity mud and less easily in the higher-resistivity formation. If a probe electrode M is inserted between A and B, the voltage prevailing at the probe point can be measured. Since the shapes and positions of the equipotential surfaces are influenced by the mud and formation resistivities, the voltage at M is a function of formation resistivity.

. . . Resistance of a formation to current flow is directly proportional to the current-path length and inversely proportional to the path's cross-sectional area. This relation may be expressed mathematically as:

$$R = r\,L/A \qquad (5)$$

where R is the total resistance of that volume of formation through which the current flows, L and A are the length and cross-sectional area respectively of that volume of formation, and r is a proportionality constant. Equation 5 can be rearranged to:

$$r = R\,A/L \qquad (6)$$

If R is measured in ohms, A in square meters, and L in meters, the units of r then become:

$$r = \text{ohm-meters}^2/\text{meter} \qquad (7)$$

For a cubic meter of formation, A is 1 sq. m., L is 1 m., and by Equation 5

$$r = R\,(1/1) = R \qquad (8)$$

Hence r is the specific resistivity of a cubic meter of formation and has units of ohm-meters^2/meter. These units are always shown on the headings of resistivity logs.

The numerical resistivities of formations shown on electric logs are only approximate. The resistivities are known as apparent rather than true values. Many factors are responsible for the variances between apparent and true resistivities. The effects of these factors and methods of converting ap-

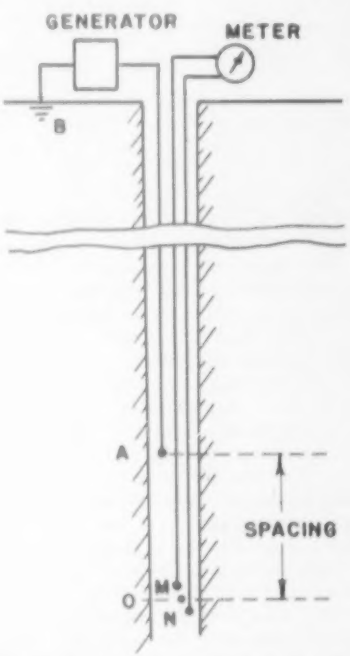


Fig. 14—Electrode arrangement of the lateral curve device. A is current electrode and potential between M and N is measured.

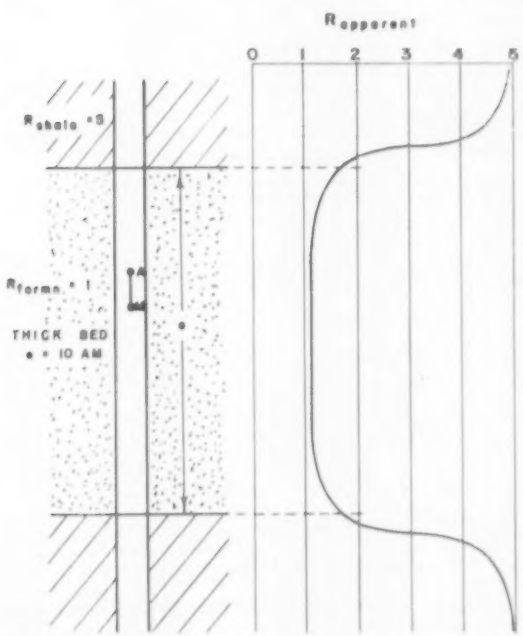
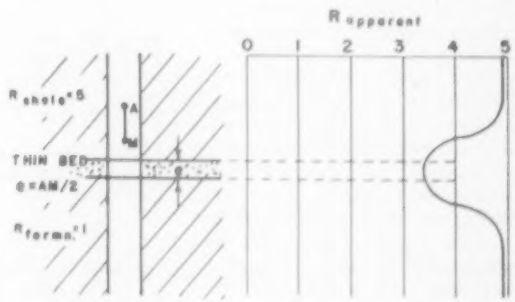


Fig. 13a. (left) — Normal curves record very nearly the true resistivity in thick, low resistivity formations.

Fig. 13b. (below)—In thin, low-resistive formations, apparent resistivity is too high but thin-sand humps are not present.



parent values to true values will be discussed later.

Resistivity Curves: Normal Device

Fig. 10 showed the insertion of a probe electrode M for measuring the voltage at a distance AM from power electrode A. A sketch of the measuring circuit is shown in Fig. 11 where A and B are power electrodes and M the measuring electrode. Such voltage measurements can be converted by mathematical formulas into formation-resistivity values. In practice, the logging recorder is calibrated in resistivity rather than voltage units, and the mathematical conversion is made automatically.

The electrode arrangement of Fig. 11 is used to record normal curves, and the distance AM is called the spacing of the device. The concentric equipotential spheres of Fig. 11 show that the depth of formation investigation increases with an increase in AM. Short-normal curves are recorded with an AM spacing of 5 to 20 in. (usually 16 in.), and long-normal curves with an AM spacing of 20 to 84 in. (usually 64 in.). Long-normal measurements are less influenced by mud-filtrate invasion than short-normal measurements. Accordingly the former more accurately represent true formation resistivities; however, it will be shown later that the accuracy of resistivity measurement also depends on other factors.

The electrode arrangement of the normal device records curves that are symmetrical with respect to the midpoint of AM. For the ideal case of a homogeneous formation bounded on both sides by thick zones of equal resistivity that portion of the normal curve below the center of the formation is an inverted image of that above. Fig. 12a illustrates this condition. In cases where the resistivities of the adjacent formations are not equal or where the zone being logged is not homogeneous, the normal curve becomes distorted in symmetry.

The effects of formation thickness on the theoretical shapes and amplitudes of normal curves are shown in Figs. 12 and 13. In Fig. 12 the formation is assumed to be a uniform sand of moderate resistivity bounded by two infinitely thick equiresistant shale zones. The relative resistivity values are shown on the figure.

Fig. 12a shows the characteristic curve for the normal device where the AM spacing is less than the formation thickness. In this figure the apparent resistivity begins increasing at some point above the formation, attaining a maximum value when the midpoint of AM reaches the center of the formation. From the maximum value the resistivity decreases again to the value of the shale resistivity at a point below the formation.

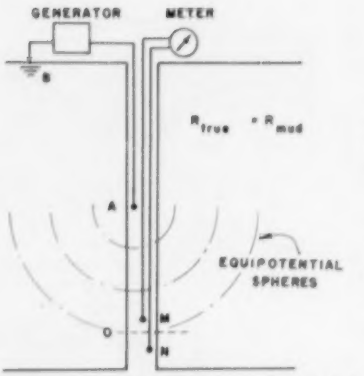


Fig. 15—Deep investigation is characteristic of the lateral curve. Increasing the distance AO increases the depth of formation measured.

Fig. 12b shows the typical curve for the normal device where the AM spacing is greater than the formation thickness. Immediately above and below the formation slight humps in the curve prevail; however, opposite the formation the curve is depressed below the shale-resistivity value. Thus a formation more resistive than shale erroneously appears to be more conductive. It is important to note from the figure that the distance between humps is definitely related to formation thickness and AM spacing.

The formations shown in Fig. 13 have lower resistivities than the bounding shale bodies. The values are indicated on the figure. In Fig. 13a the formation thickness is greater than the AM spacing. The characteristic curve for this case is recessed and is essentially an inversion of that of Fig. 12a. The response for a formation whose thickness is less than the AM spacing is shown in Fig. 13b. This curve is characterized by a decrease in amplitude as is that of Fig. 13a; however, the "thin-sand humps" of Fig. 12b are not present.

Resistivity Curves: Lateral Device

A sketch of the type of electrode arrangement used to record lateral curves is shown in Fig. 14. Comparison of this figure with Fig. 11 shows the differences between lateral and normal electrode arrangements. To facilitate operations the lateral arrangement used in practice is the electrical reciprocal of the one shown in Fig. 14; however, the circuit shown will be used for illustrative purposes because practical symbolic and spacing designations refer to this hookup.

A and B of Fig. 14 are power electrodes, and M and N are measuring electrodes. An electric current is emitted at A, and the potential difference between M and N is measured. Formation resistivities are derived from these measurements by mathematical conversions. In practice the recording device is directly calibrated in resistivity rather than potential units, and the mathematical conversions are made automatically. The distance MN is small compared to the distance AO, where O is the midpoint of MN. Consequently the point O is the spacing reference, and AO is called the lateral spacing.

The hypothetical conditions of Fig. 15 shows that the depth of resistivity investigation into a formation is proportional to the AO spacing. Wider spacing results in a deeper investigation penetration. Lateral spacings are appreciably greater than normal spacings, and usually a spacing of 18 ft. 8 in. is utilized.

Lateral curves are dissymmetrical about the midpoint of the electrode spacing. Hence, that portion of the curve below the center of a resistive formation differs in shape from that above, and the midpoint of a formation cannot readily be located from a lateral curve. Actually the lateral curve does not clearly define either the middle or the top of a resistive formation; however, it fairly accurately marks a formation's bottom boundary.

NELSON REFINERY CONSTRUCTION INDEX

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

Index (1946 = 100)

	1948	1950	1952	1953	1954	Oct. 1955
Pumps, compressors, etc.	127.0	138.2	155.6	162.5	166.5	178.0
Electrical machinery	127.6	134.9	152.4	156.4	160.0	165.7
Internal-combustion engines	116.9	126.0	146.5	148.1	150.5	159.1
Instruments	120.0	127.8	146.2	151.8	154.6	168.8
Heat exchangers	130.0	140.0	165.8	174.9	171.7	162.9
Miscellaneous equipment average	*122.1	*126.2	153.3	158.8	160.7	166.9
Materials component	139.3	149.5	164.3	172.4	174.6	181.5
Labor component	128.0	144.0	163.1	174.2	183.3	192.6
Nelson construction index	132.5	146.2	163.6	173.5	179.8	188.2

*Used in computing the Nelson Index until April 1952. These are slightly different from the average of the Miscellaneous Equipment Items shown above.

ELEMENTS OF FIELD PROCESSING—9

Mist Extraction—An Art, or a Science?

This is the first of several installments on mist extraction. The author presents some general principles before discussing available equipment

by John M. Campbell

MIST extraction is one of the most important factors entering into the design of field processing equipment, including separators, stabilizers, scrubbers, etc. Although the principles are well established, at the present time their design is somewhat more an art than a science, the factors used being largely empirical.

The equipment used usually employs one or more of the following mechanisms: (1) gravity settling, (2) centrifugal force, (3) impingement, (4) electrostatic precipitation, (5) sonic precipitation, (6) filtration, (7) adhesive separation, (8) adsorption, or (9) thermal.

The problem is amplified because particles of varying size and characteristics, both liquid and solid, must be removed. Furthermore size and cost of the equipment required are always practical factors.

Particle size . . . This is normally defined by its diameter in microns, 1 μ being 1/25,400 in. The particles greater than 10 μ may be readily separated by existing equipment. Those smaller, sometimes referred to as particulates, represent a serious problem. Up until the present time at least the use of settling, impingement, centrifugal force, and filtration have not been generally effective in handling these small particles. The other processes as yet have not been generally used on high-pressure gas because of several serious limitations.

There are several ways of describing the average particle diameter:

1. Diameter of a sphere having average volume:

$$Dp = \left[\frac{\Sigma (n D^3)}{\Sigma n} \right]^{1/3} \quad (1)$$

2. Diameter of sphere having average area:

$$Dp = \frac{\Sigma (n D^2)^{1/2}}{\Sigma n} \quad (2)$$

3. Diameter of sphere having geometric mean diameter:

$$Dp = e^{-B} \quad (3)$$

where:

$$B = \frac{\Sigma (n \ln D)}{\Sigma n}$$

Dp = average particle diameter
D = diameter of given size particle
n = number of particles of given size (dimensionless)
(D and Dp in consistent units)

Author is with the department of petroleum engineering, University of Oklahoma, and a consulting engineer.

PRODUCING

The normal probability of particle sizes normally takes the form shown in curve a, Fig. 1. Often the curve will be skewed to the right or left as with curve b or several peaks may be encountered as with c.

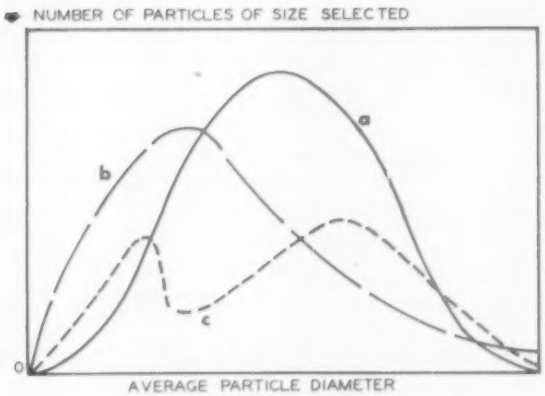
The determination of average particle size is relatively easy with solids but no method yielding reproducible data has yet been devised for liquids. This determination of particle size may be considered somewhat academic because size changes continually in an actual line—yet it is by necessity the logical starting point in mist-extractor design.

The general principles and limitations of the most common processes are reviewed here as a preface to detailed discussions on available equipment. Detailed mathematical treatment for these processes may be found in the references.

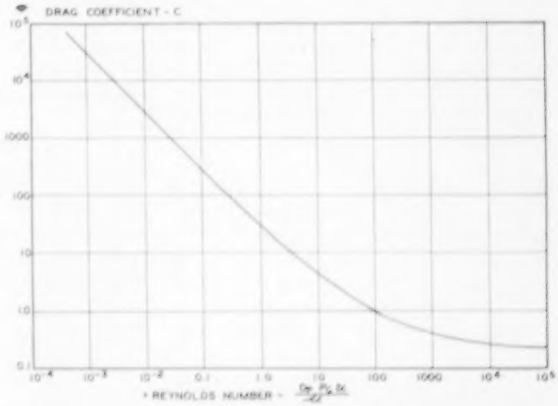
Properties of Particles

Most particles have no electrical charges of any magnitude, therefore if a charge is desired (electrostatic precipitation) this must normally be imposed by artificial means. For all practical purposes the particles may be considered inert.

Although particles of widely varying absolute density are encountered, their bulk density is generally not much larger than that of the gas. Conse-



TYPICAL particle-size distribution. Fig. 1.



VARIATION of drag coefficient C with Reynolds number—for spheres.[4]

"Determination of particle size is logical starting point in mist-extractor design."

quently separation by gravity is logically limited to particles of relatively large size. It is only above 10 μ that their higher density starts having an effect.

The vapor pressure of a small particle does not differ from that of a large mass of the same fluid until the size reaches about 0.01 μ. Since a particle of this size is not considered entrainment, it may be said that vapor pressure remains constant.

An entrained liquid system is basically unstable, the particles either coalescing or vaporizing if given sufficient time. This time is basically inversely proportional to size and proportional to the amount of interparticle contact. It is on this latter premise that impingement separators are based. Basically then the purpose of a liquid mist extractor is to accomplish this disappearance in a reasonable length of time.

Liquid properties such as surface-tension affect the coalescence and subsequent removal and therefore enter into the design.

The varying chemical properties of particles is of little consequence for the processes normally used do not involve these considerations. The difference in chemical properties between glycol and crude oil, for example, does not affect entrainment separation although their physical properties do.

General Considerations

The general physical "laws" governing the behavior of particles in an idealized system have been formulated (see bibliography). In their application to actual systems, however, certain assumptions are necessary which limit their effectiveness. They provide though a means of measuring the relative effect of various influences on particle behavior. In reality many commercial mist-extraction units combine several of the mechanisms listed above and it is difficult, if not impossible, to determine their absolute effect, or their effect on each other. However, from a mathematical standpoint, it is necessary to consider each process separately.

Gravity separation . . . The terminal velocity of a particle settling under the action of gravity may be found from the equation:

$$v_t = \left[\frac{4g\, Dp\, (\rho_L - \rho_G)}{3\, \rho_G\, c} \right]^{1/2} \quad (4)$$

which takes into account the gravitational forces and those resisting settling. Newton's law describes the resisting or drag force resisting the motion of the particle during turbulent flow. This force is normally described by a drag coefficient g. The relationship between this coefficient and Reynolds number is shown in Fig. 2. In the turbulent-flow region ($500 < Re < 200{,}000$) Fig. 2 shows that c has an average value of 0.44 for spheres.

If the gas flow is laminar (viscous) the relationship developed by Stokes applies and Equation 4 becomes:

$$v_t = \frac{g\, Dp^2\, (\rho_L - \rho_G)}{18\, \mu} \quad (5)$$

Centrifugal settling . . . Stokes law may be applied to this process if the effect of gravity g is replaced by a, the acceleration due to centrifugal force. The terminal velocity then becomes:

$$v_t = \frac{a\, Dp^2\, (\rho_L - \rho_G)}{18\, \mu} \quad (6)$$

By considering the gas velocity to be constant it is possible to obtain:

$$Dp = \left[\frac{9\, \mu\, s}{\pi\, V_a\, N\, (\rho_L - \rho_G)} \right]^{1/2} \quad (7)$$

where:

Dp = particle size that will be collected by centrifugal force.

Impingement . . . As the gas approaches a fiber it curves around but the momentum of the entrained droplet tends to move it straight ahead. It therefore becomes critical to determine the distance across the flow path necessary to stop the particle. On the assumption that Stokes law applies:

$$s = \frac{Dp^2\, \rho_G\, V_i}{18\, \mu} \quad (8)$$

These equations and others describing other mechanisms of separation are shown by Montross[7] and Lapple.[5]

Nomenclature

a = acceleration due to centrifugal force, ft./sec.^{2}

c = drag coefficient, dimensionless.

D = any particle diameter, ft.

Dp = average particle diameter, ft.

g = acceleration due to gravity, ft./sec,^{2}

n = number of particles of given size, dimensionless.

N = "effective" number of turns made in centrifugal separator.

v_t = particle terminal velocity, ft./sec.

v = relative velocity between particle and main body of gas, ft./sec.

V_a = average velocity of particle laden gas, ft./sec.

V_i = initial velocity of particle, ft./sec.

ρ_L = density of liquid, lb./ft.^{3}

ρ_G = density of gas, lb./ft.^{3}

μ = viscosity of gas, lb./ft./sec.

s = radial path of particle, ft.

π = 3.1416.

Errata

Part 7, The Oil and Gas Journal, Vol. 54, No. 26, October 31 (1955)—Length of sample bomb in figure on page 97 should be 2 ft. instead of 21 ft. On page 95 valves H and J are not normally furnished by the separator manufacturer.

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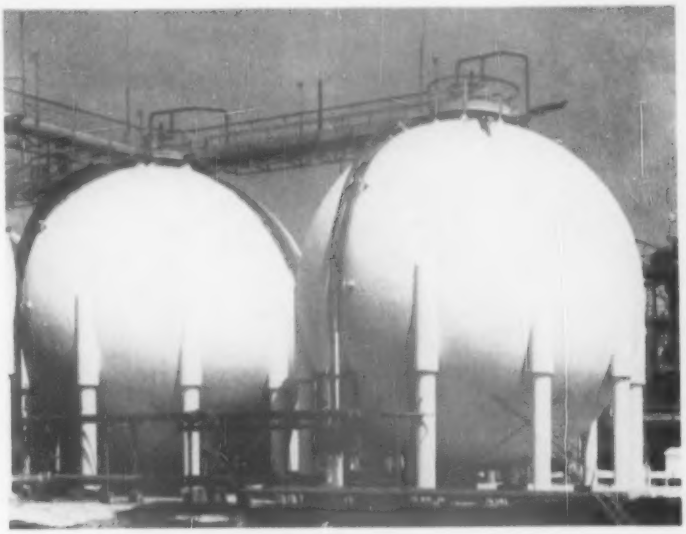
CONSTRUCTION VIEW shows Styrofoam being applied to Hortonspheres at Dow's ammonia plant. View at right shows completed installation.

by F. Lawrence Resen
District Editor



PETROCHEM REPORT:

Dow Reports Good Results From Styrofoam Insulation

STYROFOAM, a multicellular plastic foam produced by the 40-fold expansion of polystyrene, is on duty as an insulator on five Hortonspheres at Dow Chemical Co.'s Freeport, Tex., ammonia plant.

The insulating material has had a service life of 5 years and engineering inspection reports indicate satisfactory condition to date with no repairs anticipated for a long time.

The insulation was applied on the 43½-ft.-diameter spheres which hold up to 750 tons of liquid ammonia. It serves to hold down temperatures on the tanks and limit the work load on the vapor-recovery system. This system functions to collect ammonia vapor from all five tanks, recompress it, and return the liquefied ammonia to one of the tanks. During the 18 months from January 1954 to June 1955, this mechanical refrigeration system operated for a total of 3,205 hours, 24.5 per cent of the 13,104 total available operating hours during this period.

What is it? . . . Styrofoam is a lightweight, rigid plastic which resembles packed snow. The standard white type has probably been seen by the average reader in store displays during the Christmas holiday season or in ornamental pieces for the home.

In Table 2 are listed various characteristics of the material. It will be noted that it is a poor conductor of heat and has a low water-vapor transmission factor, two properties which make it desirable as a insulator. Additionally, its closed-cell structure prevents the entrance of capillary water. Only negligible amounts of water are absorbed and under submerged conditions practically all water pickup is by adsorption (surface water pickup). The material comes in different densities, i.e., 1.3, 1.6, and 2 lb. per cu. ft., with the mechanical properties relating to the 1.6-lb. per cu. ft. density.

The material is produced in the shape of logs, planks, and boards of varying dimensions. The Styrofoam is then either fabricated by contractors to meet specific requirements, i.e., preformed pipe coverings, or cut to size and shape by plant maintenance or insulating crews. Prefabricated Styrofoam for pipe covering and vessels is commercially available.

Application . . . In the ammonia-plant installation experimental procedures were followed in applying a different weather coating to each of the five spheres. The application methods, test results, and conclusions as determined by plant engineers are worthy of note.

All of the spheres were originally insulated with 4-in. Styrofoam, using low-melting-point adhesive asphalt. On the first two spheres installed (T-51 and T-52) the hot asphalt was applied on one face of the lags only and no cement was used in the joints. On the last three spheres (T-53, T-54, and T-55) the hot asphalt was applied by dipping the back of lags and two edges.

All five spheres were banded with ¾ by 0.015-in. Monel bands spaced a maximum of 2 ft. apart at the widest point. This was accomplished by using two floating rings, one at the top and one at the bottom of the sphere. The rings were ⅜-in. steel rod, 10 ft. in diameter.

The insulation was received in planks which were 4 in. thick, 12 in. wide, and 9 ft. long. These were cut into 3-ft. lengths and then tapered and beveled to fit. The full plank width was used on the courses around the sphere except at the top and bottom where the taper of each block was such that two wedge-shaped lags could be cut out of each 12-in.-width plank. Lags were applied vertically in courses around the sphere.

In protective coating experiments, all of the systems used followed good practices, with the main effort directed at finding a best system for this particular application.

Sphere 51 . . . Monel wire netting (1-in. hexagon mesh 20 gage wire) was stretched over the entire sphere and then sprayed with two coats of Micro-

Seal 3A (an asphaltic material) to approximately ⅛-in. thickness.

Shortly after completion, line cracks appeared in the weather coating at most of the block joints. It was felt this was due to shrinkage of the blocks due to incomplete curing. These cracks did not grow as exposure period was extended. The weathercoat had a rough surface due to spraying, but was in good condition.

Sphere 52 . . . This had the same treating as T-51 except that two trowel coats of Armstrong Insulmastic was applied instead of the Micro-Seal. Some 20-30 blisters formed on this weathercoat. They were 4-10 in. in diameter and filled with water. It was found that they had formed between the coats of Insulmastic and the Styrofoam was still protected. Some hairline cracks were visible in the coating at the joints.

TABLE 1—OPERATING HOURS—MECHANICAL REFRIGERATION SYSTEM

1954—	Hours
January	136
February	228
March	161
April	110
May	172
June	335
July	287
August	241
September	212
October	76
November	170
December	193
1955—	
January	214
February	95
March	107
April	186
May	39
June	243
Total	3,205
Total available operating hours	13,104
Per cent operating time	24.5

TABLE 2—CHARACTERISTICS OF STYROFOAM

	Psi.
Mechanical properties at 77° F.:	
Compressive yield strength	15-25
Tensile strength	50-70
Shear strength	25-35
Compressive modulus	750-1,350
Bending modulus	650-1,200
Impact strength (⅜-in. by ½-in. section), in./lb.	1.1-1.8
Thermal properties:	
Thermal conductivity (K-factor), B.t.u./sq. ft./hr./°F./in.—0.23-0.30 at mean temp. of 40° F.	
Linear thermal coefficient of expansion—2 to 5 × 10^{-5} in./in./°F. between —320° F. and 50° F.	
Specific heat—0.27 B.t.u./lb./°F. at 40°F.	
Resistance to heat—maximum recommended temperature for continued use—175° F.	
Water adsorption:	
Less than 6 per cent by volume (for volumes greater than a 2-in. cube).	
Less than 0.1 lb./sq. ft. of area.	
Water vapor transmission:	
1.5-3.0 grains/sq. ft./hr./in. of thickness/in. of Hg vapor pressure difference.	
Electric properties:	
Dielectric constant—less than 1.05 from 10^2 to 10^6 c.p.s.	
Power factor—less than 0.002 from 10^2 to 10^6 c.p.s.	

Sphere T-53 . . . The top half of this sphere was covered with 30-lb. roofing felt applied with hot asphalt. The hot asphalt was hot mopped on the felt and the felt was then applied like wallpaper. Monel wire netting, 1-in. hex mesh, was stretched over the entire sphere. Two trowel coats of emulsified asphaltum mixed with asbestos fiber and sand were then applied. Mixture was as follows:

50 gal. Insulmatic.

112 lb. asbestos fibers.

275 lb. (2¾ cu. ft.) dry screened sand.

15 gal. clean water.

After exposure, the top half of the sphere was found to be in very good condition. Lower half of the sphere was in good condition with a few hairline cracks in the coating at the block joints.

Vessel T-54 . . . The top half of the sphere was given a ¼-in. trowel coat of asbestos portland cement hard coating mixed as follows:

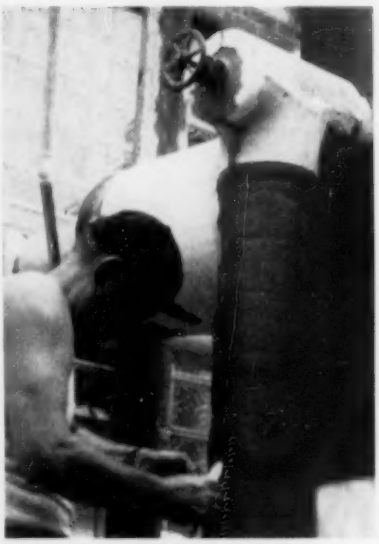
1 part asbestos fiber (by weight).

1 part portland cement.

3 parts dry screened sand.

Clean water to mix to trowel consistency.

Monel wire netting, 1-in. hex mesh, was stretched over the entire sphere and two coats of Armstrong Insulmatic were then troweled on as a weathercoat.



Prefabricated Styrofoam is also available for pipe and vessel coverings.

After exposure, the sphere looked very good. Some hairline cracks developed in the weathercoat at the joints.

Vessel T-55 . . . Same treatment was applied here as in the foregoing case except two trowel coats of Micro-Seal No. 3 was mixed with asbestos fiber and perlite. This mixture was made as follows:

To each 55-gal. drum of Micro-Seal was added 100 lb. of asbestos shorts and 2½ cu. ft. of perlite to make a trowel consistency.

This sphere appeared in very good condition and was probably the best weather conditioned of the five. A few hairline cracks did appear at the joints.

All five spheres were given two coats of white paint after the weathercoat had sufficiently cured.

Conclusions . . . All of the vessels remain in satisfactory condition and no repairs are anticipated for some long time. It is felt that the hairline cracks may have been caused by slight shrinkage of the blocks. Its worthy to note that the cracks developed shortly after completion and were not prominent on the sides of the vessel exposed to the sun.

The 30-lb. asphalt-saturated roofing felt on T-53 sphere eliminated the cracks and it is felt that this should be used on the top half of the vessel. An advantage may also be gained in having a cold application material rather than hot asphalt for applying the felt.

The use of a light aggregate, such as the perlite in T-55's coat is recommended over sand.

Future . . . On coming jobs, galvanized bands and wire mesh would probably be used rather than the Monel. The 30-lb. roofing felt would be applied on the top half of the vessel and a thin trowel coat of hard-finish asbestos portland cement on the lower half to provide a smooth even surface. This would all be covered with the wire mesh and two trowel coats of weathercoat, such as was used on Vessel T-55, would be applied. Two coats of white paint would complete the job.

Acknowledgments

Cooperation of Dow Chemical Co.'s management in the release of this material and the assistance of O. F. Schumm and G. M. Lindveit in collecting of data are gratefully appreciated and acknowledged.

Reference

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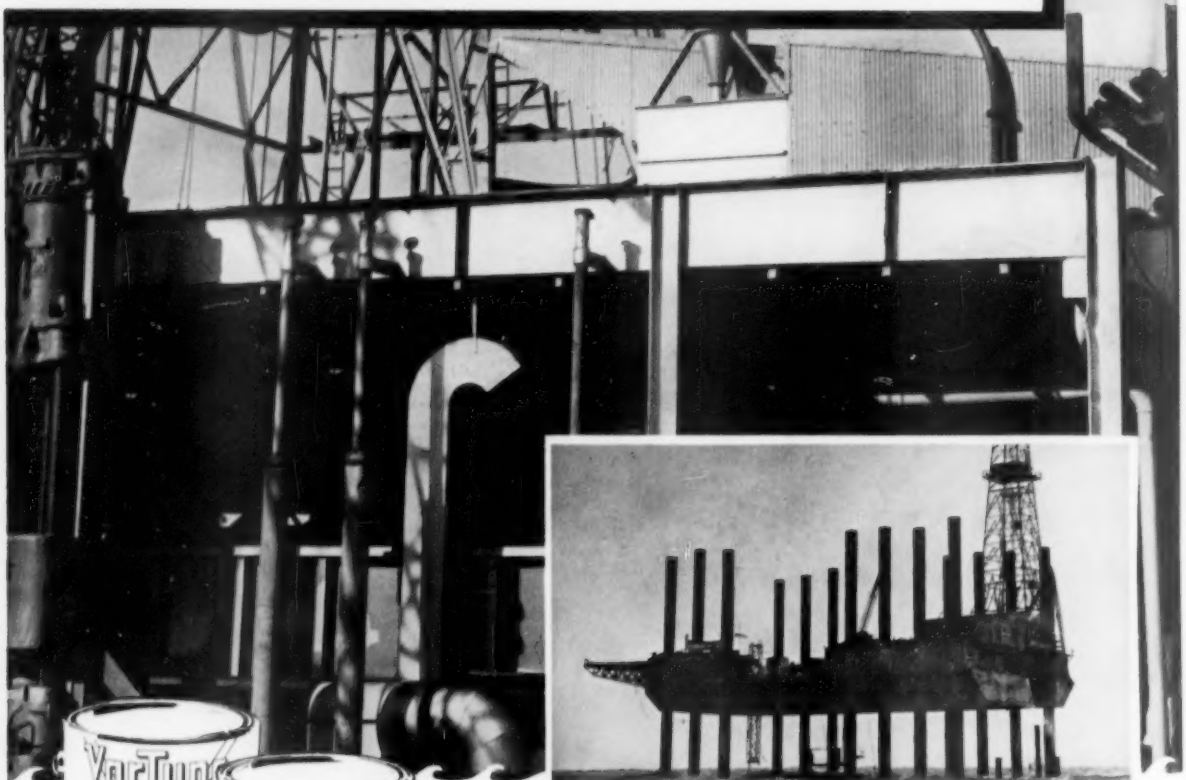

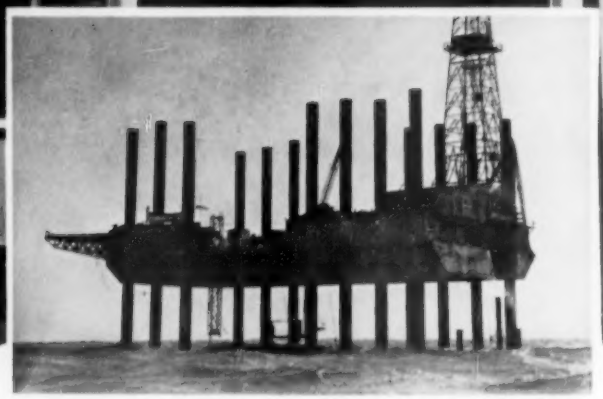

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THERMAL REFORMING UNIT of the Dunkirk refinery is designed for 6,800 bbl. per day of naphtha. Fractionating tower and clay towers are at left, and the gas towers and blowdown system are at right.

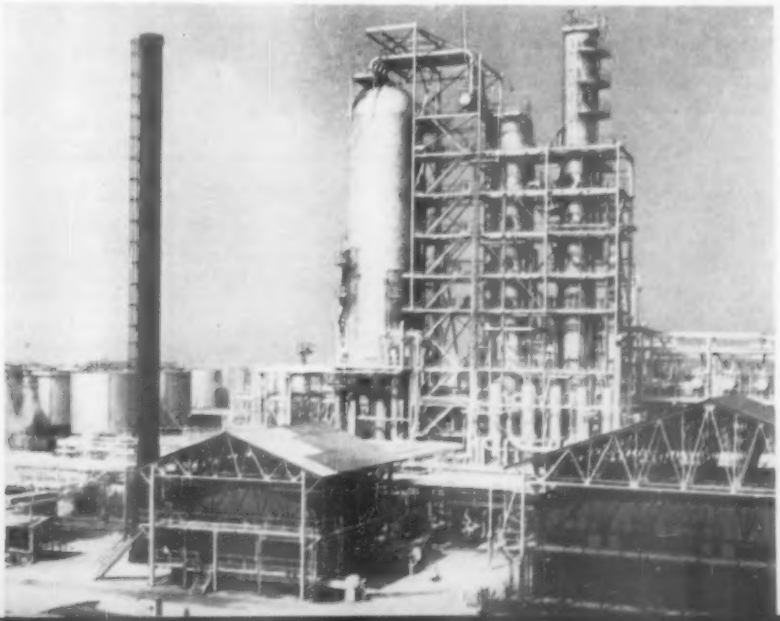
B.P. Operates Complete Plant at Dunkirk

Kuwait crude charged to this 41,000-bbl. plant of S.F.B.P.

THE Dunkirk refinery of S.F.B.P. (French subsidiary of British Petroleum Co.) was constructed between 1949 and 1951. It is located on the North Sea, on the site of the former Petrofina refinery which was completely destroyed during the last war.

It is a complete refinery with a capacity of 2,000,000 tons a year (41,000 bbl. per day), producing the complete range of petroleum products from liquefied gas to lubricating oils and asphalts. At present the crude oil processed comes from Kuwait.

ATMOSPHERIC-VACUUM DISTILLATION UNIT is designed to process 26,000 bbl. per day of crude and 9,000 bbl. per day of atmospheric residue.



Refining units . . . These units are included in the processing scheme for light products and distillates for lube manufacture:

1. A small crude-distillation unit which was moved from the old S.F.B.P. refinery at Courchelettes.
2. A combined unit with atmospheric-distillation section, and a vacuum section which produces the distillates for lube-oil manufacture.
3. A thermal reformer which can be run either on once-through or recycle operation. It is equipped to produce butane and propane.
4. A rectification and treating unit for butane and propane.
5. Treating units for light products, including caustic soda washing of gasoline and copper chloride slurry unit. The raw material for special solvents is treated with sulfuric acid.
6. A small rerun unit is used for obtaining solvents from light cuts coming from the atmospheric unit.

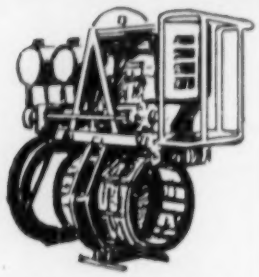
Lube-oil units . . . The lubricating-oil units have a nominal capacity of 55,000 tons (113 million pounds) of lubes per year. However, the throughput has

Wrap up your pipeline problems **in one package!**

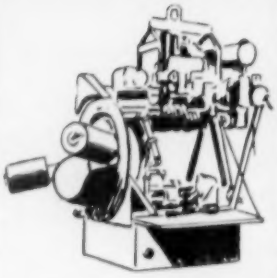
CROSE

You can go right down the line with dependable CROSE pipeline equipment — specialized for every pipeline construction operation and ruggedly built to stand the gaff.

THE MOST RUGGED PIPELINE TEAM IN THE WORLD!



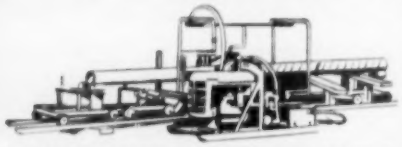
COUNTER-ROTATING CLEANING AND PRIMING MACHINES



SPRAY-RING TYPE COATING AND WRAPPING MACHINES

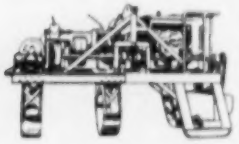
STATIONARY CLEANING AND PRIMING MACHINES
FOR PORTABLE OR PERMANENT INSTALLATIONS

INTERNAL LINE-UP CLAMPS
AIR OR MANUALLY OPERATED

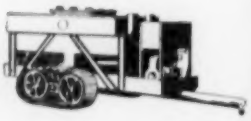


STATIONARY COATING AND WRAPPING MACHINES
FOR PORTABLE OR PERMANENT INSTALLATIONS

PIPELINE CRADLES
FOR EASY ROLLING ACTION UNDER LOADS



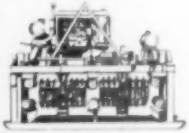
ROAD BORING MACHINES
FOR 4" TO 48" CASING



PIPELINE COATING KETTLES
HYDRAULICALLY AGITATED

COUPON CUTTER
FOR FAST, ACCURATE COUPON CUTS

PIPE ROLLING RIGS
FOR MANUALLY COATING AND WRAPPING SMALL AMOUNTS OF PIPE



MODEL MX CLEANING AND PRIMING MACHINES
FOR THOROUGH PIPE RECONDITIONING

M. J. CROSE MANUFACTURING CO., INC.

2715 DAWSON ROAD • PHONE MAdison 6-2172 • TULSA, OKLAHOMA

15225 EAST COLFAX AVENUE, AURORA, COLORADO • 500 FIFTH AVENUE, NEW YORK CITY

DISTRIBUTORS:

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been considerably increased by improving the operating conditions and by several minor modifications to the process.

The units are as follows:

1. A propane-deasphalting unit which treats the residue from the vacuum unit.

2. A furfural unit treating the distillates from the vacuum unit and also the heavy stock extracted in the propane-deasphalting unit.

3. A methyl-ethyl-ketone dewaxing unit, combined with a recrystallization wax recovery section. The filtration takes place in four rotary filters and the necessary chilling is obtained by an adjacent ammonia refrigerating plant.

4. A high-temperature clay-treatment unit with a rotary filter. The spent clay is disposed of hydraulically.

5. A wax-treating unit followed by molding presses and a packing section.

6. An asphalt plant producing the complete range of hot asphalts, emulsifiable grades, and cutbacks. Dispatch is in bulk or in drums and the refinery has a drum plant which can turn out 70,000 drums of 43.5 gal. per month.

One particular of the lube-oil units is that the heat required for the process is provided by two central furnaces which circulate gas oil at 300° C. (572° F.)

The refinery furnaces are heated by refinery gas and fuel.

The control rooms of the principal units have graphic panels.

Of the 15 refinery units, 6 were designed by Lummus Co. (combination unit, special solvent rerun, copper chloride treatment for naphthas and gasolines, asphalt plant, clay contact, and propane-deasphalting unit).

Two others were designed by Lummus and Texaco (furfural and M.E.K. dewaxing). Kellogg is responsible for the thermal reformer and S.F.B.P. for the remaining five (rectification and treatment of propane and butane, caustic treater for light products, acid treatment of light solvents and naphtha, wax treatment).

LIGHT PRODUCTS

Unit—	Designed capacity bbl. per day
No. 1 topper	7,500
Combined atmospheric section	26,000
Thermal reformer	6,800
Vacuum distillation	9,000
Deasphalting unit	1,800
Furfural extraction unit	2,000
M.E.K. dewaxing unit	1,300
Clay contact unit	1,000

Shipping and receiving . . . The main jetty is 322 ft. long by 125 ft. wide with a berth each side, and it is connected to the shore by 428 ft. of roadway. It stands in the basin of Dunkirk harbor which is connected to the sea by a lock which can take 33,000-ton tankers. The crude for the refinery arrives at this jetty and the products which are taken away by tanker are loaded here.

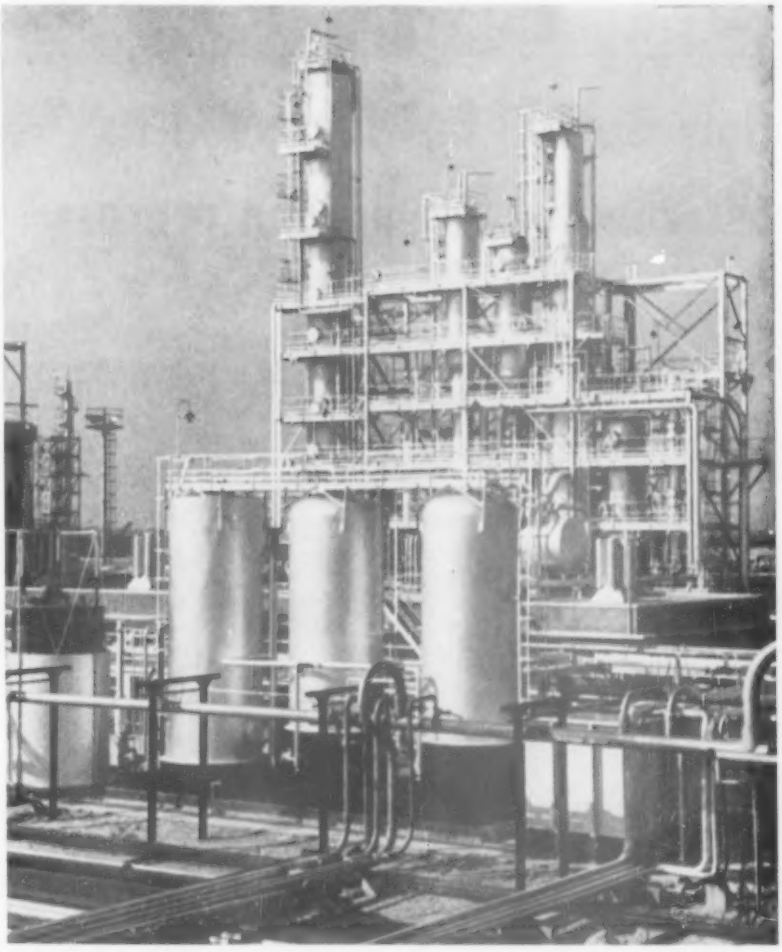
In addition there is a quay 690 ft. long which can take two small boats up to 8,000 tons each or four barges.

The traffic by road and rail is also important and in 1954 the proportion of tonnages dispatched by the different means were as follows.

PRODUCT SHIPPING

Tankers and coasters	20 per cent
Rail	36 per cent
Road	14 per cent
Pipeline	17 per cent
Barnes	13 per cent

The refinery also has a bottling plant for butane and propane which dispatches these products by rail and road, and there are facilities for dispatching bitumen in drums.



FURFURAL UNIT with extraction tower and solvent recovery towers in the background.

General services . . . The boiler house contains three total-radiation-type boilers with a nominal capacity of 50 ton-hours each. The steam is produced at 925 psi. and 907° F. After passing through two turbogenerators it is distributed in the refinery at 200 and 57 psi.

The boiler-feed water is treated in two ion-exchange units with bipermutation and silica removal. These units can provide 120 tons per hour of treated water by simple filtration across the resins. They are among the largest of this type in Europe.

Electrical power is furnished by the turbo alternators which can be connected with the electrical grid supply. The power house produces 88 per cent of the total electrical requirements of the refinery.

The cooling water pump house can circulate 238,000 gal. per hour of sea water.

Personnel . . . The total number of employes is 1,250, of whom about 75 per cent are in the packaging department. Housing is provided for 22 per cent and transport to and from the refinery for 50 per cent of the total.

How Bel Oil has improved its natural-gas dehydration process

by W. J. Stroud

NATURAL-GAS dehydration with lower initial cost, less maintenance, no wet-gas recycle, and better regeneration from both water and oil saturation. These are the main features of a 20-M.M.c.f.d. dehydration unit operated by Bel Oil Corp. at the North Elton field gasoline plant.

Use of low-pressure gas provides a bonus in better water removal and is particularly advantageous in regeneration.

The dehydration vessels are charged with 1,000 lb. of Alcoa Alumina H-151 per tower. Design was based on 12 lb. of water per 100 lb. of desiccant. Actual capacity of the H-151 was found to be about 18 lb. of water per 100 lb. of desiccant after 1 year of operation and several absorption oil baths. Gas is dried from 10 lb. of water per M.M.c.f. to less than 6 lb. of water per M.M.c.f.

Cycle . . . A 24-hour cycle is used. After a 24-hour run, the tower is sealed off and vented to flare. Then 20 psig. of flare gas from the plant processing area is heated to 420° F. by a small radiant-type heater. This gas is passed through the bed countercurrent to normal flow and returned to the flare line. This prevents wet-gas recycle.

Author is plant superintendent Bel Oil Corp., Elton, La.

In about 8 hours, some 100 M.c.f. of 420° F., 20-psig. gas has heated the bed to about 340° F. on the outlet side. The tower is allowed to sit for 16 hours with no gas flowing through it. When it is repressured and put back on the line, outlet temperatures jump 25°-30° for 2 to 3 minutes, then drop rapidly back to the normal 80° F.

Using low-pressure gas . . . The water capacity of low-pressure gas is much greater than that of the 700-psig. gas that would normally be used in this unit for regeneration. For example, at 80° F., 20-psig. gas is saturated at 700 lb. of water per M.M.c.f. gas while 700-psig. gas is saturated at only 41 lb. water per M.M.c.f., the capacity of the lower pressure gas being some 17 times greater than that of 700-psig. gas

The hot, low-pressure gas will carry off more and heavier hydrocarbons at the 400° to 500° F. normally used for regeneration than gas at a higher pressure. The use of low-pressure gas, when available, gives a bonus in better water removal and particularly in hydrocarbon removal. So it might well be used to advantage in conventional units designed for regeneration with high-pressure gas.

Savings . . . On initial cost of the unit, these were estimated as follows:

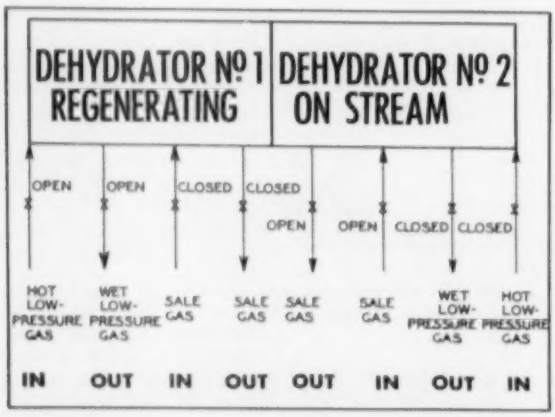
$4,000—High-pressure heat exchangers and coolers
1,000—To make heater used suitable for high-pressure gas
700—Miscellaneous valves and fittings

$5,700—Estimated total savings.

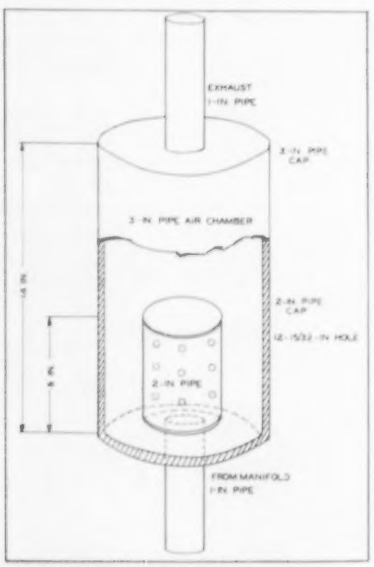
The cost of the unit, ready to operate, with all labor but less the cost of the gas heater (which was surplus plant property) was $8,900.

Manifold . . . As part of the layout a special manifold has been built to eliminate errors when switching from one dehydrator to the other. The valves are arranged in a horizontal line, and piping is run so that the operator can start at one end by closing the first valve in line and then changing the position of every other valve (see sketch). If the first valve in line is closed, it means he is at the wrong end of the manifold and should start at the other end.

The first two valves (hot low-pressure gas in and wet low-pressure gas out, respectively) on either end are open during regeneration. The second two are closed. This insures sealing off the low-pressure gas system first and opening it last. The third and fourth valves in from each end are sales gas in and sales gas out, respectively. With this arrangement, the operator should avoid turning the sales gas line to flare.



ARRANGEMENT of valves on dehydrator manifold is such as to prevent operator from turning sales gas line to flare.



Home-made silencer quiets a noisy air motor

A NOISY air motor operating small plate rolls in the boiler shop at Sinclair Refining Co.'s Houston plant

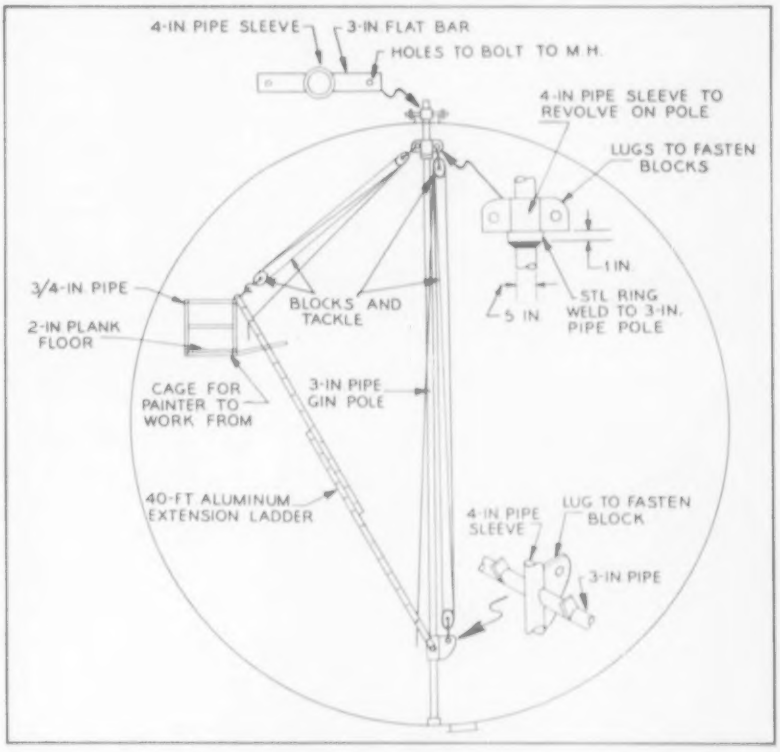
was quieted by means of a shop-fabricated silencer.

The silencer consists of: (1) a 1-in. inlet line connected to the exhaust manifold of the motor; (2) a discharging section for absorbing the immediate force of the air exhaust; (3) a large air chamber; and (4) a final outlet line.

The discharging section was made from a 6-in. length of 2-in. pipe. Capped at one end, it contains 12 15/32-in. perforations spaced evenly about its cylindrical wall. The open end of this perforated pipe was welded to a 3-in. pipe cap, making up one end of the air chamber. A hole was cut in the pipe cap to permit the inlet line to enter into the discharge section and, in effect, into the air chamber.

The air chamber consists of a 14-in. length of 3-in. pipe, capped at the one end as noted and also capped at the other end. A 1-in. outlet line is mounted in this cap.

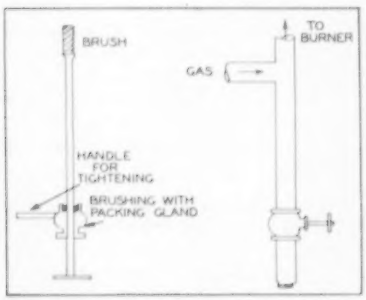
Exhaust air enters the discharging section, passes through the perforated holes in its walls, then passes through the air chamber and finally out of the chamber through the 1-in. outlet line.



Portable scaffold simplifies tank painting

THIS new-type portable scaffold has proven useful in sandblasting and painting tanks. Its use has been particularly advantageous with spherical tanks, but it is also adaptable for use with the blimp type.

With the new-type scaffold, the time of erection and dismantling is reduced considerably and increased efficiency of operation is realized. A 6-ft. strip can be sandblasted or painted completely around the tank, then the scaffold can be raised or lowered in 5 minutes time. Suggestion was by E. C. Jennings of Phillips Petroleum Co. natural-gasoline department.



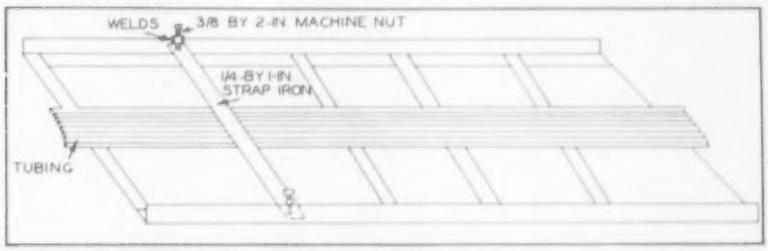
You can make this tool for cleaning gas burners

GAS burners may be cleaned while a heater or furnace is in operation by means of this simply constructed tool.

The cleaning tool consists of a wire brush mounted on a rod, along with a bushing and a packing gland. The brush is inserted in the burner line and the bushing is made up into threads at the lower end of the line. A handle is welded on the bushing to eliminate the need for any hand tools.

Once the bushing has been made up, a valve located somewhat above it (but below the gas inlet to the burner) is opened. Then the wire brush may then be pushed upward to the burner.

Courtesy Sinclair Refining Co., Houston.



Built-in clamps hold instrument lines firm

A SERIES of built-in clamps on tubing troughs will hold instrument lines securely in position and simplify the addition of extra lines.

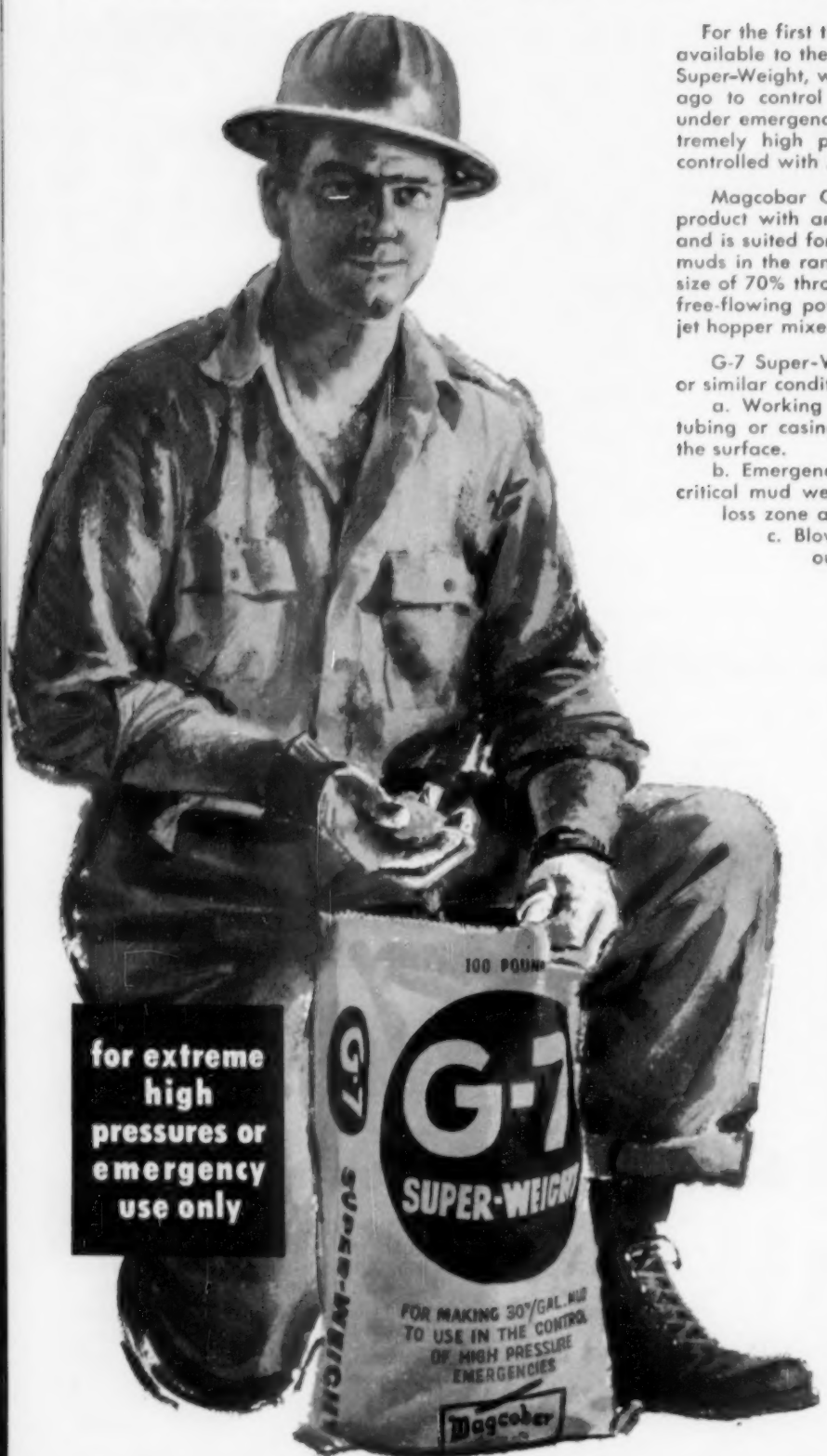
The clamps consist merely of a strap-iron crossbar held in place by bolts which are threaded through nuts welded to the top edge of the angle-iron extremities of the trough. The tubing is stretched in the trough, and the clamp is placed above it and secured by screwing down the bolts.

The clamps should normally be about 6 ft. apart. Each should be located above one of the supporting cross members of the trough.

INTRODUCING

Magcobar G-7 SUPER-WEIGHT

The Oil Industry's First Field-Proved Weighting Material for Making 30 lb. Mud


100 POUNDS
G-7
SUPER-WEIGHT
FOR MAKING 30#/GAL. MUD TO USE IN THE CONTROL OF HIGH PRESSURE EMERGENCIES
Magcobar
for extreme high pressures or emergency use only

For the first time, a **field-proved** 30 lbs./gal. mud is available to the oil industry! This mud, Magcobar G-7 Super-Weight, was first used successfully nearly a year ago to control extremely high subsurface pressures under emergency conditions. Since that time other extremely high pressure wells have been successfully controlled with Magcobar G-7.

Magcobar G-7 Super-Weight is a finely ground product with an unusually high specific gravity (7.0) and is suited for preparation of extremely high weight muds in the range of 26-32 lbs./gal. It has a particle size of 70% through 325 mesh. It is a charcoal colored free-flowing powder which is easily mixed through a jet hopper mixer.

G-7 Super-Weight muds can be used under these or similar conditions:

a. Working over high pressure wells, in which tubing or casing failure has occurred relatively near the surface.

b. Emergency situations in drilling wells, where a critical mud weight balance exists between an upper loss zone and a lower high pressure zone.

c. Blow-out wells, in which the normal blow-out prevention procedures have failed or are not economically practical.

The preparation of special high weight muds with Magcobar G-7 requires considerable care in that a balance between support of weighting material and viscosity for pumpability must be maintained through the correct quantity of low gravity solids.

MAGCOBAR G-7 IS NOT RECOMMENDED FOR USE IN THE NORMAL DRILLING OPERATION. If you have an emergency drilling condition that cannot be safely controlled with regular 20 lbs./gal. Magcobar muds, it is recommended that you contact your Magcobar field engineer for specific study and recommendations for your problem. A stock of Magcobar G-7 is maintained at New Orleans, Louisiana, and is available from this stock through all Magcobar dealers.

Magcobar
Complete
DRILLING MUD SERVICE

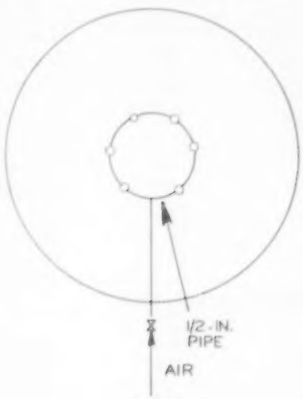
MAGNET COVE BARIUM CORPORATION

HOUSTON, TEXAS

Concentric Air Rings Check Precipitate Accumulation

IN a filter unit, accumulation of precipitate in the bottom of floc tanks using air agitation from a single air ring was eliminated by the installation of a second air ring concentric with the first in the bottom of the tanks.

Initially, a single small air ring was installed in the tanks which would pro-

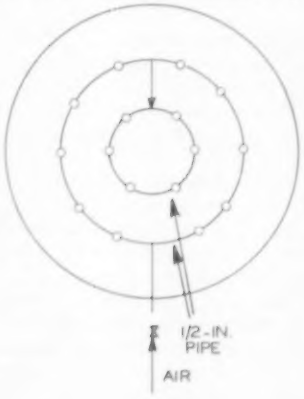


BEFORE

vide sufficient mixing to prevent settling out of dense precipitate when the tank was full of floc sludge. However, as the sludge was pumped out of the tank and the level dropped, the mixing was confined to the center of the tank directly over the air ring. Result: the precipitate accumulated in the bottom of the tank outside the ring.

When this very dense material was pumped to the filter, a very thick layer of heavy precipitate was left on the filters. This thick layer would be dropped onto the conveyor belt and the load would often cause the belt to break.

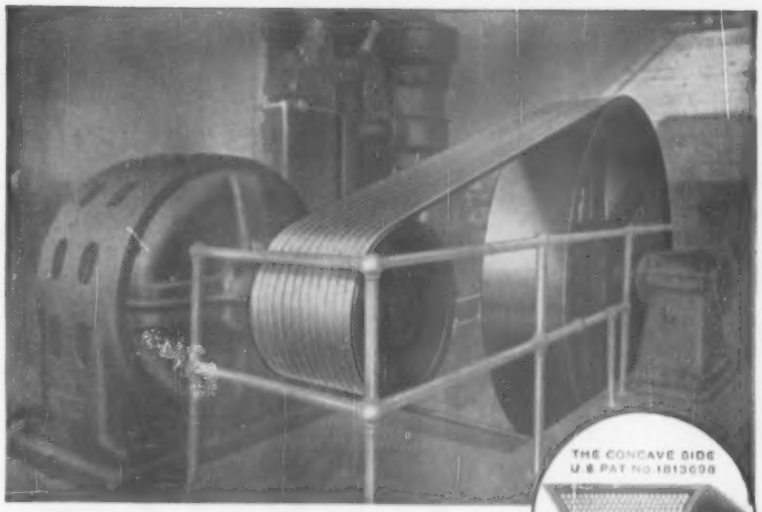
This situation was eliminated by the



AFTER

installation of a second air ring in the bottom of the tanks.

Method suggested by Bernard Thomas Owin, helper. Courtesy Humble Oil & Refining Co., Baytown, Tex.



Why a V-Belt with

CONCAVE SIDES

wears longer

It is easy to demonstrate to yourself why the concave sides (Fig. 1) of the Gates belt greatly lengthen belt life.

Simply bend a Gates belt and feel the sides. Notice how these precisely engineered concave sides *fill out* on the bend and *become straight.* Thus a Gates belt grips the sheave groove evenly (Fig. 1-A) and wear is distributed uniformly across each side of the belt. That means longer belt life; lower costs.

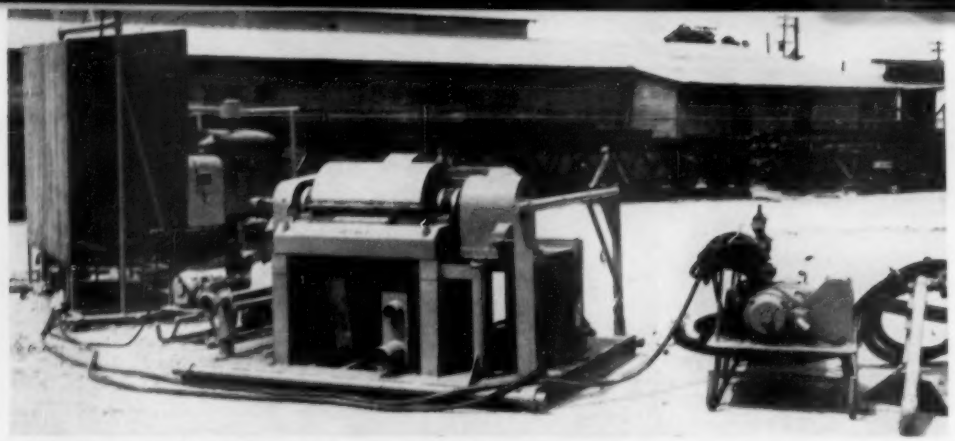
Make the same test with a straight-sided belt (Fig. 2) and see what happens. The sides bulge out on the bend (Fig. 2-A) concentrating the wear at points shown by arrows.

To assure longer wear and keep belt costs down, specify the V-belt with concave sides—Gates Vulco Rope . . . readily available from nearby distributor stocks. The Gates Rubber Company, Denver, Colorado —*World's Largest Maker of V-Belts.*

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 68

Gates VULCO ROPE Drives



DECANTING-TYPE CENTRIFUGE found so profitable in Gulf Coast mud treatment. Unit has its own power generator and control room, (left).

Beginning . . . A four-article section on drilling muds.

Centrifuge Cuts Mud Costs

. . . on a South Louisiana well

Continental Oil Co. recently completed testing a drilling-mud centrifuge on four development wells in Rayne, Louisiana, field, Louisiana. On the 2 T Petitjean, the machine effected a net saving of $7,200 while the hole was drilled from 9,200 to 13,000 ft. Here are some conclusions from use of this centrifuge.

1. Although primarily productive with weights in excess of 14 lb. per gal., the centrifuge can cut costs on mud in the 12 lb. per gal. range where bentonitic shales normally force adding large quantities of water in order to control viscosity.
2. Reclaiming barite from reserve mud can save money.
3. The decanting-type centrifuge is mechanically sound and simple to operate.

by Ed McGhee

CONTINENTAL OIL CO. put a decanting-type mud centrifuge to work on lightweight mud on its 2 T. Petitjean in the Rayne, Louisiana, field and saved money. The centrifuge conditioned mud weighing an average of 12 lb. per gallon from 9,200 to 10,800 ft. while a 12¼-in. hole was being drilled. At 10,800 ft., 8⅝-in. protection casing was run. Thereafter, while the centrifuge maintained lightweight mud, 7⅞-in. hole was drilled to 13,000 ft. where 5½-in. protection string was set.

Previously, on two wells, the centrifuge had been used for viscosity control of only heavy 15.7 to 16.3-lb. per gallon mud after protection string was set. For these operations, an average net saving of $1.42 per foot was effected for the interval of centrifuge operation.

Installing the centrifuge at 9,200 ft. on the 2 T. Petitjean provided the opportunity to evaluate further cost savings by viscosity control of mud in the 12-lb. per gallon weight range by removal of low-gravity solids while drilling through bentonitic beds. Advantages of weighting up the mud system after drilling out from protection string with the centrifuge reclaiming barite from salvage mud were also found.

Assigning net saving as value of mud saved less unit rental and cost of mud transfer, the total net saving was $7,200 or $1.89 per foot drilled.

Mud during solids control . . . The mud was converted to an M-1 oil-emulsion mud at 7,500 ft. When the centrifuge was placed in operation at 9,200 ft., the mud weighed 11.0 lb. per gallon. Mud weight was gradually increased to 12.6 lb. per gallon at 10,800 ft. where protection string was set.

DRILLING

During the interval the centrifuge was in operation, no jetting was required. The only water added was that required to maintain mud volume. Aside from barite used for normal weight increase, additional barite was needed for rebuilding volume following trips. This resulted in a reduced net saving from the centrifuge on the upper hole.

Approximately 800 bbl. of mud is normally jetted in the drilling of this depth interval. The interval contains highly bentonitic shales and this volume results from water required to control viscosity. The centrifuge, by removal of the low-gravity shale particles, allowed viscosity and gel strength control of the mud without "waterback."

Low-weight mud savings . . . Table 1 shows average mud properties and mud cost of three other wells drilling in Rayne field as compared with the 2 T. Petitjean at 10,800 ft. Mud program and depth of the 12¼-in. hole is the same for the four wells. For comparison, the mud costs are taken from one price list, f.o.b. well site and include mud used from conversion to setting of protection string.

The net saving for this part of the hole by means of the centrifuge is interpreted as the cost difference between average mud expense for the three wells and subject well less unit rental.

Gross saving	$2,329
Unit rental	1,200
Net saving	$1,129

Centrifuge operation . . . Sand had a tendency to pack between the conveyor

and outer bowl at the solids discharge end of the centrifuge. This was, to a large extent, remedied by increasing water-to-solids ratio in the discharge and increasing water to maximum flow when flushing unit prior to shutdown.

There was also some mechanical trouble with the engine that powers the centrifuge unit and with controls on the mud-feed pump. However, these were minor, easily repaired, and reflected in no way on the operation of the centrifuge.

For the 1,600 ft. of 12¼-in. hole over which the centrifuge operated, the total time and average control data are as follows:

Total operating hours	155
Water to mud feed, g.p.m.	4
Water to solids discharge, g.p.m.	8
Centrifuge speed, r.p.m.	1,800
Mud processed based on pump rating, bbl.	3,543
Weight of effluent, lb. per gal.	9.8

The effluent, or low-gravity discharge, had at times sufficient bentonitic solids to produce a 35-second per quart viscosity and a slight gel strength.

Mud with reclaimed barite . . . Before drilling out from 8⅝-in. casing, the settling tank was cleaned and isolated from the circulating system. A total of 833 bbl. of reserve pit mud with an average weight of 13.5 lb. per gallon was transferred and put in the settling tank over a 12-day period. The centrifuge took suction from the settling tank and discharged barite into the circulating system.

Table 2 shows the barite requirements for subject well as compared with the requirements for the three wells that were used for the averages of Table 1. The sacks of barite shown are those used only from protection string to the depths shown. The cost shown is total mud cost from conversion point and is based on one price list, f.o.b. well site.

Throughout the depth interval shown, the centrifuge was used solely to salvage barite. This was stopped at 12,500 ft. since it was unwise to draw reserve mud stocks too low. If needed, the centrifuge suction could have been placed in the circulating system; however, the viscosity remained low.

A cost analysis for centrifuge operation could be interpreted in various ways. The cost analysis below is based on the date production casing was set —15 days after last operation of the centrifuge. An analysis of mud expense for the four wells considered, indicate that cost from protection string to 12,500 ft. closely followed barite requirements. Below this point, lost circulation on the various wells changed the cost structure. The second basis for cost comparison will, therefore, be an average of barite requirements for the three wells from protection string to 12,500 ft. as compared with the subject well.

Average barite used from protection string to 12,500 ft.	6735 sx or	$13,807
Barite used on subject well for same interval	1965 sx or	4,029
Gross saving	4770 sx or	$ 9,778
Centrifuge rental May 19-June 19		$ 3,100
Transfer expense for 833 bbl. of mud		516
Net expense		$ 3,616
Net saving		$ 6,162

Salvage operation . . . Since the mud placed in the settling tank was lighter than that in the system, it was not practical to gun the tank. Although drawing from viscous mud, the mud-feed pump maintained prime and an occasional backflush with water was the only attention needed.

Total time and average control data are as follows:

Total operating hours	181
Water to mud feed, g.p.m.	6
Water to solids discharge, g.p.m.	2.5
Torque, ft.-lb.	28
Mud pump speed, r.p.m.	400
Weight of effluent, lb. per gal.	9.2
Barite output based on average barite required less sack barite added, lb. per hour	2,635

As volume increased in the active tanks, mud was bypassed into the settling tank for rerun. Surface volume, therefore, remained constant throughout the salvage and weighting operation. The following estimate of volume handled is within field accuracy:

Volume of mud transferred	833
Volume of barite slurry added based on average barite required, bbl.	455
Volume of water added from solids discharge, bbl.	65
Volume of oil added, bbl.	167
Total, bbl.	1,510
Rated pump displacement based on 181 hours at 400 r.p.m., bbl.	2,063
Per cent rated displacement	73

TABLE 1—LOW-WEIGHT MUD PROPERTIES AND COST AT 10,800 FT.

A.P.I. mud properties—	Average of three wells		T. Pettitjean No. 2	
Weight, pounds per gallon	12.6		12.7	
Viscosity, seconds	62		47	
Plastic viscosity, cp.	26		15	
Yield, pounds per 100 sq. ft.	19		15	
Gels, grams:				
Initial	0		0	
10 minutes	9		0	
Water loss, cc.	5.0		4.2	
Cake, 32nds of inch	2		2	
Lime, pounds per barrel	1.2		1.2	
Oil, per cent by volume	12		10	
Solids, per cent by volume	22		20	
Material used—	Amount	Cost	Amount	Cost
Barite, sacks	4,992	$10,233	3,965	$8,129
Caustic, poundy	3,340	243	3,400	247
Quebracho, pounds	5,350	963	5,850	1,053
Calcium lignosulfonate, pounds	6,333	1,054	5,400	899
Lime, pounds	10,900	175	11,950	191
Starch, pounds	4,483	701	5,000	782
Diesel, gallons	18,301	2,288	19,694	2,462
Mica, sacks	286	950	155	515
Total cost		$16,607		$14,278

Difference: $2,329

TABLE 2—BARITE REQUIREMENTS FOR HIGH WEIGHT MUD

	Dupuis No. 1	Dugas No. 1	W. Petitjean & Co. No. 3	*T. Petitjean No. 2
Size casing, in.	9⅝	9⅝	8⅝	8⅝
Size hole, in.	8¾	8¾	7⅞	7⅞
Depth, ft.	11,513	11,479	11,541	11,615
Weight, pounds per gallon	15.0	14.9	15.0	14.9
Barite, sacks	3,778	4,288	3,485	617
Total cost	$25,999	$29,876	$25,767	$17,561
Depth, ft.	12,050	11,927	12,007	12,065
Weight, pounds per gallon	15.5	15.5	15.5	15.5
Barite, sacks	5,056	5,974	5,113	1,310
Total cost	$29,872	$34,237	$29,900	$20,787
Depth, ft.	12,508	12,490	12,528	12,505
Weight, pounds per gallon	15.8	15.8	15.7	15.7
Barite, sacks	6,392	6,933	6,880	1,965
Total cost	$34,235	$37,251	$34,678	$23,546

*Subject well.

Acknowledgment

Credit is due C. N. Hefner, of Continental's Lafayette, La., office for furnishing the information contained in this article.

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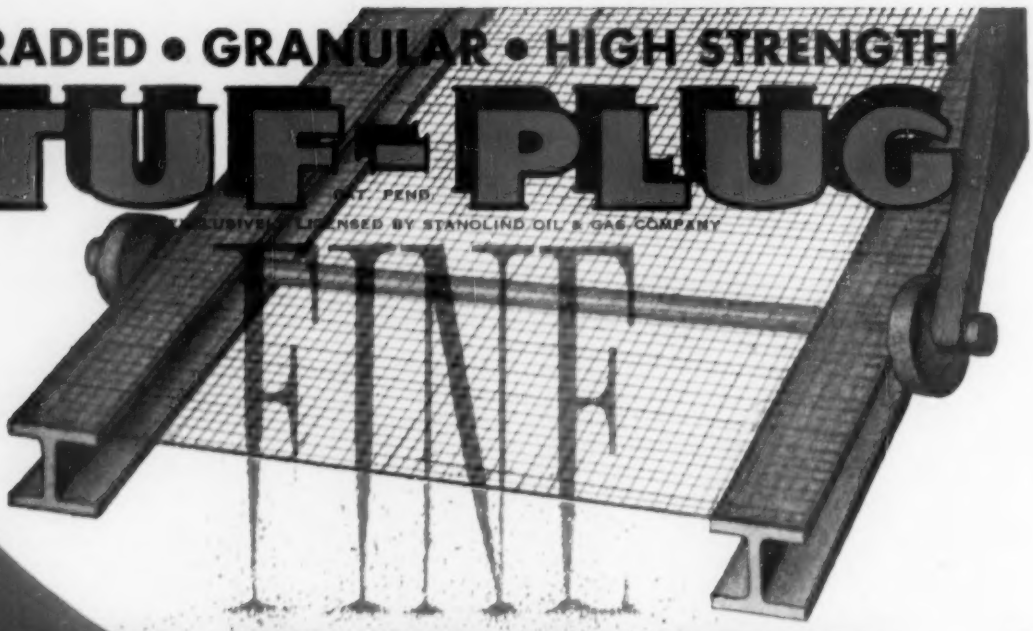

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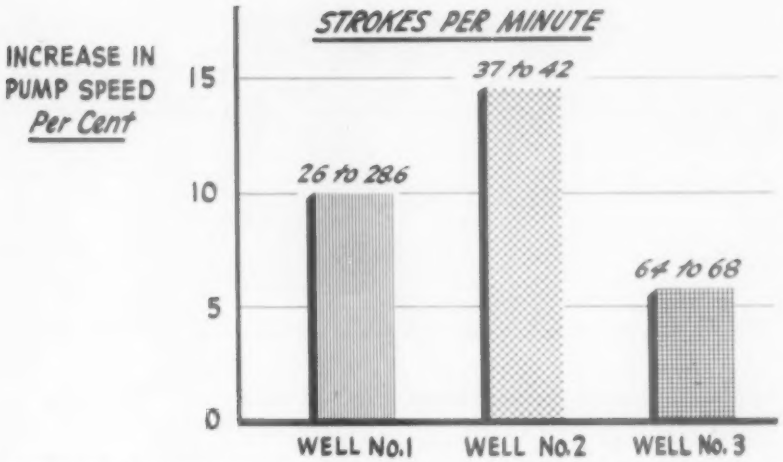
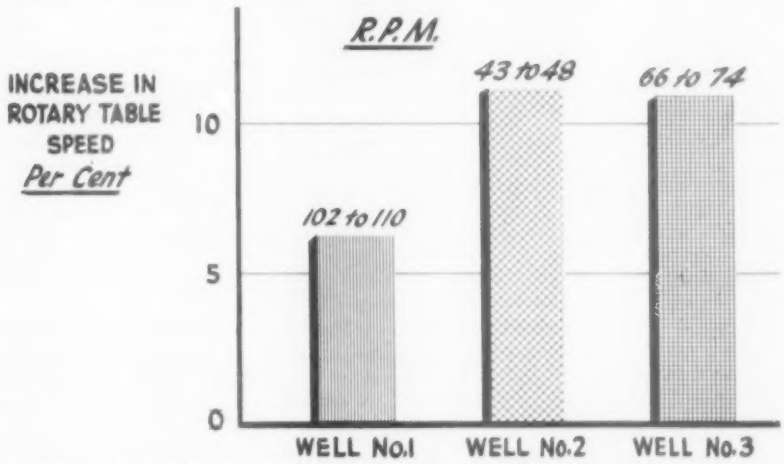


INCREASE IN PUMP SPEED by addition of fine walnut shells to drilling fluid in West Texas wells. (Compounded drive, constant throttle). Fig. 1.



INCREASE IN ROTARY-TABLE speed by addition of fine walnut shells to drilling fluid in West Texas wells. (Compounded drive, constant throttle). Fig. 2.

How walnut shells help you get

More Power at Hole Bottom

by David A. Garrick

LABORATORY investigations[1] have shown that granular materials having certain physical properties (such as those found in walnut shells) are superior to flaked or fibrous materials for sealing simulated fractures.

These results have been substantiated by numerous field tests in most of the active drilling areas of the United States and Canada. Besides being a widely used agent for controlling lost circulation, walnut shells have been used successfully as a sealing agent while squeeze-cementing perforations, cementing casing, and stimulating production by acidizing and hydraulically fracturing formations.

Other useful functions of walnut shells in drilling mud have been revealed in recent laboratory and field studies. These are: (1) **Reduction of drill-pipe torque and drag,** and (2) **reduction of the amount of shale solids that tend to accumulate in the mud in some areas.**

The author is president, Cherokee Laboratories, Inc., Tulsa.

DRILLING

Drilling Muds

Reducing Torque

A recent paper gave results of tests which indicated that walnut shells (ground to a particle size range of 30 to 100 mesh) are effective in drilling fluids for reducing friction between steel surfaces and steel and rock surfaces—for example, between drill pipe and casing and between drill pipe and open-hole walls. Recent experience in the field has confirmed this finding. Indications are that the addition of 1 to 4 lb. of walnut shells to each barrel of mud offers these advantages in reducing friction.

1. Reduced wear on drill pipe.
2. Minimized danger of drill pipe twist-offs by lowering torque.
3. Reduced drag when lifting pipe out of the hole.
4. More uniform weight on bit.

The decrease in drill-pipe torque with the use of 2 lb. of walnut shells per barrel of drilling fluid has been evidenced in West Texas wells by increases in pump and rotary-table speed with a constant throttle setting on compounded drives. Figs. 1 and 2 show the percentage increase in pump speed and rotary-table speed measured on three West Texas wells after walnut shells were added to the drilling mud in a concentration of 2 lb. per barrel.

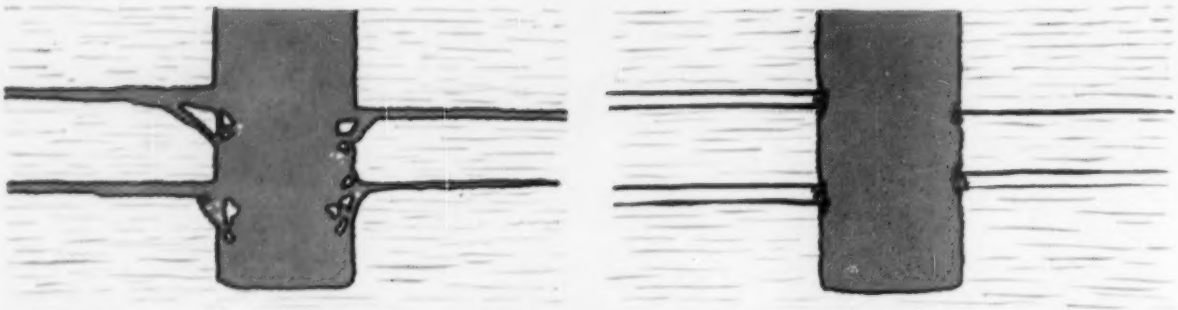
Table 1 shows the reduction of drill-pipe torque and drag as a result of the use of walnut shells in the drilling mud of a well in Val Verde County, Texas. The torque was measured by counting the number of turns of backlash of the drill pipe when the clutch was slipped after the drill pipe was rotated. The term "drag" refers to the hook load above the weight of the drill pipe as the pipe was lifted from bottom of hole.

Control of Shale Solids

Mud engineers supervising the use of fine walnut shells as a lost-circulation preventive material have noted that muds containing this additive tend to accumulate formation solids at a lower rate than offset wells drilled with muds which did not contain walnut shells. In one instance, the solids content of the mud remained at a constant level during the drilling of a thick section. In a previous well, this section caused a rapid shale-content increase in the mud.

It is theorized that the 30 to 100-mesh walnut-shell particles seal hairline fractures in shale, or interbedded permeable sand streaks in the shale, as depicted in Fig. 3. By doing so, they prevent intrusion of mud into the formation which could later cause sloughing of the shale.

Case histories demonstrating this function of walnut shells have been



SLOUGHING of shale by mud intrusion is shown at left, while diagram at right shows reduction of shale sloughing by preventing intrusion of mud with fine walnut shells. Fig. 3.

obtained on five wells. Data on the actual percentage of shale solids at different drilling intervals versus the percentage of shale solids in an offset well drilled under the same conditions are lacking. But the evidence contained in these case histories is enough to warrant the conclusion that use of fine walnut shells helps to prevent a buildup of shale solids in the drilling mud.

Well No. 1, Hidalgo County, Texas . . . The drilling mud in this well was pretreated with 2 lb. of fine walnut shells per barrel in order to prevent loss of mud to induced-type fractures. The engineers who serviced this well reported that the clay-solids content of the mud remained at an unusually low level while drilling the interval from 5,600 to 9,303 ft. The mud bill for this well was $9,300 compared to a normal cost of $20,000, not including the cost of lost mud.

Well No. 2, Sterling County, Texas . . . The weight of the drilling mud, which contained from 2 to 3 lb. of fine walnut shells per barrel, remained at about 9.4 lb. per gal. during drilling from 6,270 to 7,005 ft. in black shale. During drilling of the same interval in an offset well, the weight of a drilling mud increased from 9.4 to 9.8 lb. per gal. when no additive was used.

Well No. 3, Tom Lyne field, Texas . . . The use of fine walnut shells in the mud resulted in an unusually low buildup of clay solids during the drilling of the interval from 7,784 to 10,000 ft. The cost of mud on this well was $15,500 as compared to a mud bill for offset wells ranging from $20,000 to as high as $70,000.

Well No. 4, Wildcat Sea Rock Island, Texas . . . As a lost-circulation preventive measure, 2 lb. of fine walnut shells per barrel of mud were added at a depth of 8,400 ft. This concentration was maintained to the total depth of 10,525 ft. The drilling mud required only small additions of water and treating chemicals to maintain satisfactory properties. This was attributed to the low rate of solids buildup after addition of the walnut shells.

Well No. 5, Hidalgo County, Texas . . . A concentration of fine walnut shells of 1 lb. per barrel was maintained in the mud over a drilling interval from 5,500 to 10,152 ft. A low maintenance cost was experienced, which was attributed to the low rate of shale solids buildup in the mud. The total mud bill on this well was approximately $45,000 as compared to $85,000 for an offset well.

Preventing Loss of Mud

One of the most difficult mud problems in the Texas and Louisiana Gulf Coast is preventing the loss of muds to induced-type fractures. Walnut shells ground to a particle size range of 30 to 100 mesh have been found by laboratory tests to seal larger fractures, and withstand higher differential pressures than other materials ground to the same particle size range.[2]

The advantage of using this smaller grind is that the loss of circulation can be controlled without bypassing the shale shaker. This is important, particularly in deep, hot wells, because the accumulation of solids which results from bypassing the shale shaker can contribute to other mud problems such as high-temperature solidification of lime-base muds, salt-water flows, gas kicks, etc.

. . . The function of a fine grind of material in drilling muds is to plug small hairline fractures as they are encountered. This prevents these small fractures from being enlarged by mud intrusion. For this reason, operators have found it desirable to add from 2 to 5 lb. of 30 to 100-mesh walnut shells to each barrel of the drilling mud both before drilling incompetent zones and when increasing the weight of the mud. There have also been some indications that the presence of walnut shells in the mud filter cake reduces the frequency of formation breakdown by pressure surges.

The unique property of walnut shells to resist attrition and water logging makes it possible for this material to be carried in the mud for long periods of time with unimpaired effectiveness.

Field results . . . In one area in Vermilion Parish, Louisiana, loss of circulation to induced fractures had been occurring between 11,550 and 12,000 ft. with drilling muds weighing 16.3 lb. per gal. One operator initiated a prevention program by treating the mud with fine walnut shells in a concentration of 3 lb. per barrel prior to penetrating the lost-circulation zone. This practice enabled the drilling of this normally troublesome section with complete returns using a mud weighing 17.7 lb. per gal.

In a Louisiana offshore well, a pretreatment of the mud with 3 lb. of fine walnut shells per barrel afforded a means of successfully drilling a formation which in nearby wells had caused severe lost-circulation problems.

TABLE 1—REDUCTION OF DRILL-PIPE TORQUE AND DRAG BY ADDITION OF WALNUT SHELLS TO DRILLING MUD IN A WELL IN VAL VERDE COUNTY, TEXAS

(8¾-in. hole, 6¼-in. drill collars, 3½-in. drill pipe, depth, 10,260 ft.)

	Turn of backlash			Drag on drill pipe (lb.)		
No. of collars	Before addition of shell	After addition of shell	Torque reduction (per cent)	Before addition of shell	After addition of shell	Drag reduction (per cent)
27	9	4.5	50	40,000	15,000	62.5
10	4	2.75	31	35,000	10,000	71.5

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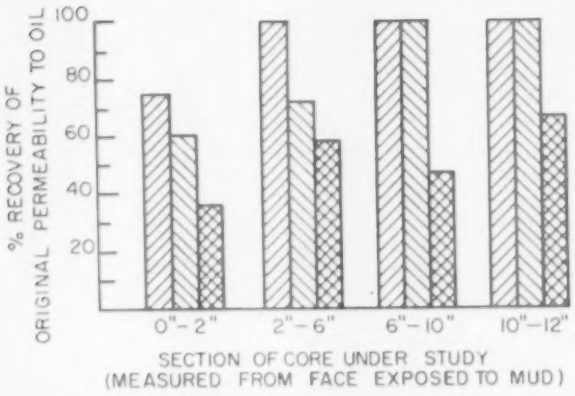
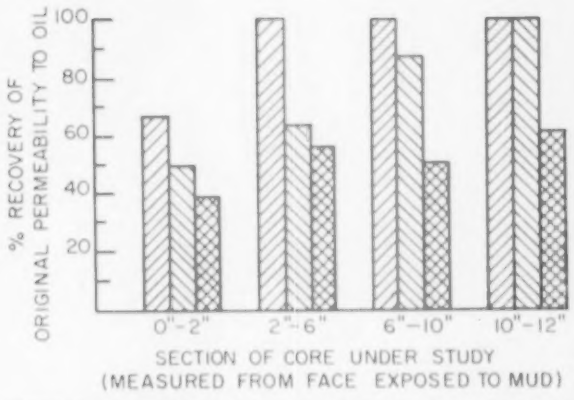
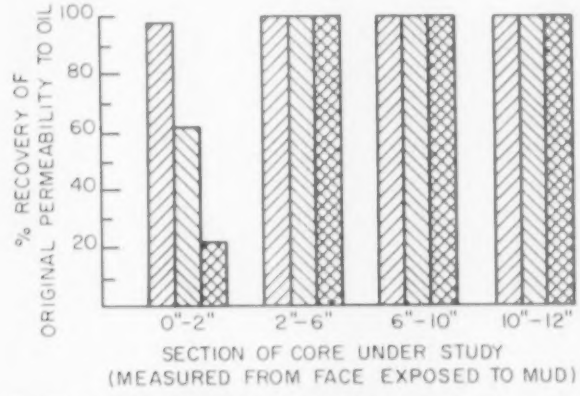


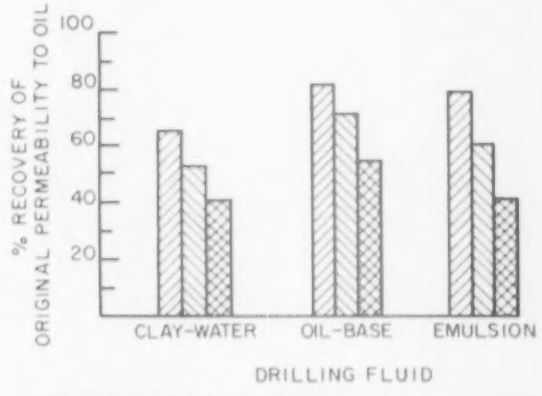
TYPICAL PENETRATION of permeability impairment in Berea sandstone cores. (Clay-water mud). Fig. 1.



TYPICAL PENETRATION of permeability impairment in Berea sandstone cores. (Emulsion mud). Fig. 2.



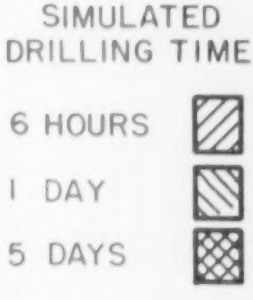
TYPICAL PENETRATION of permeability impairment in Berea sandstone cores. (Oil-base mud). Fig. 3.



AVERAGE PERMEABILITY impairment in Berea sandstone cores for all tests. (12-in. core length). Fig. 4.

What happens when drilling mud contacts a permeable formation down hole? Here are the results of tests that show that mud particles as well as mud filtrate invade the pores. Even if the filtrate doesn't affect the permeability, the particles may seriously reduce it and damage may be as deep as 12 in. in only a few days time.

by R. F. Kreuger and L. C. Vogel



What Mud Particles Do to Your Pay

How deep does damage go and how fast does it occur?

RECENTLY, tests with nonwater-sensitive sandstone cores exposed to drilling fluids under simulated drilling conditions have shown that the effective permeability to oil can be permanently impaired by penetration of particles from the mud into the interstices of the cores.[1,2]

The extent of the damage in linear cores has been shown to be a logarithmic function of the time of exposure to the mud. The depth of penetration of the particles found has been about 2 to 12 in. at the end of 5 days' exposure, depending upon the type of mud use.

This article shows the degree of permeability impairment of inert cores and

The authors are with the research department, Union Oil Co. of California, Brea, Calif.

DRILLING

How to Figure Well Damage From Core Damage

To translate permeability damage of the linear cores shown in this article to radial damage in a well, the following equivalent depths may be used:

Damage depth	
Linear core	Radial system (10-in. hole)
0 to 2 in.	0 to 1.7 in.
2 to 6 in.	1.7 to 4.2 in.
6 to 10 in.	4.2 to 6.2 in.
10 to 12 in.	6.2 to 7.0 in.

This translation assumes that the same pore volume of rock is affected in each case. With these relations, the average permeability damage of the 7 in. of rock around a bore hole would be about the same as the average permeability damage of the 12-in. linear cores.

depth of penetration of invading mud particles after various times of exposure to the drilling fluid.

Apparatus and Techniques

The flow system used to subject sandstone cores to simulated drilling conditions has been described in a previous article.[2] In general, the system consists of a means of circulating a drilling fluid past the faces of cores mounted in the test cell. For the tests described herein, the drilling-fluid temperature was controlled at 170° F. and a pressure drop of 1,000 psig. was maintained across the core specimens. Circulating velocity of the drilling fluid in the test cell averaged about 115 ft. per minute.

To simulate removal of the mud cake by the drill string, spring-loaded scraper bars were reciprocated across the core faces at a rate of 10 s.p.m.

Core treatment . . . The test specimens consisted of Berea sandstone cores, 1 in. in diameter and 12 in. long, cut parallel to the bedding plane. All cores were extracted with hydrochloric acid to remove traces of iron and then flushed with distilled water to remove residual acid. Each cleaned core was dried and mounted inside a bronze bushing with an epoxy casting resin, after which its permeability to air was determined. For these samples, the permeability range was from 400 to 600 md.

The mounted cores were evacuated, saturated with 3 per cent salt solution and then desaturated dynamically with oil (42° A.P.I. kerosine) at a pressure drop of 1,200 psi. A portion of the cores was prepared with pressure taps at points 2, 6, and 10 in. from the face. When no further water was removed from core and the oil flow rate reached a constant value, it was assumed that the core was in the restored state.

Blockage analysis . . . In these tests it is assumed that permanent changes in effective permeability to oil is caused only by particles which migrate from the drilling mud and bridge within the interstices of the core. This assumption is based on the following observations: (1) the specific permeability of the treated Berea sandstone was found to be independent of the type of filtrate or water in the pore spaces, (2) the dynamic desaturation pressure was greater than any pressure used during exposure to drilling fluid or to cleanup conditions, and (3) laboratory tests have shown that, at the cleanup pressures used, relative permeability effects have a negligible influence on the ultimate recovery of productivity of the cores after mud damage.

TABLE 1—AVERAGE PROPERTIES OF FIELD DRILLING FLUIDS USED FOR TESTS.

DRILLING FLUID	WEIGHT LB/FT³	SHEAR SHEAROMETER LB/100 FT² 0	SHEAR SHEAROMETER LB/100 FT² 10 Min.	MARSH FUNNEL VISCOSITY (SECS @ 170°F.	FLUID LOSS (API) cc ROOM TEMP. 15 MIN	ROOM TEMP. 1 HR	200°F 15 MIN	200°F 1 HR	TIME IN USE IN DRILLING WELL DAYS
EMULSION	68	0	12	45	0.8	3.2	5	9.5	27+
OIL-BASE									
SAMPLE 1	65	0	0	60	0	0	0	0	4 1/2
SAMPLE 2	63	0	0	54	0	0	0	0	11
CLAY-WATER									
SAMPLE 1	73	0	10	50	5	11	9	20	2 1/2
SAMPLE 2	74	0	TRACE	45	3.2	7.8	6	14	27

Drilling Muds

Mud used . . . For this work, samples of drilling fluids were obtained from wells in the process of being drilled. The properties of the five drilling fluids tested are shown in Table 1. Mud properties were maintained during the course of each test by addition of conventional chemicals when necessary.

With these mud samples it was possible to compare particle plugging in cores exposed not only to different types of muds (clay-water base, water-base emulsion, and oil base) but also to samples of the same type of mud representing dissimilar drilling histories.

Test Procedure

Just prior to installation of the cores in the mud-circulating system, a final determination of permeability to oil was made at a pressure drop of 600 psi. across the core. At the same time pressure readings were obtained at the pressure taps.

Subsequently, the cores were mounted in the test cell and burettes attached to the outflow ends. Initial fluid-loss measurements were taken, then circulation of the drilling fluid and reciprocation of the scraper was started. Fluid-loss measurements were made at convenient time intervals thereafter.

Tests were run for periods of time ranging from 1 hour to 100 hours or more. A typical set of tests for one drilling fluid involved times of 1 hour, 6 hours, 24 hours, and 100 hours.

Checking damage . . . At the conclusion of a specified time, a portion of the cores was removed from the test cell and reassembled in the backflow system without disturbing the mud cake. Oil was then backflowed using a pressure drop of 600 psi. across the cores in a direction counter to that of the filtrate invasion until no further increase in effective permeability was observed.

Concurrently, pressure tap readings were taken. Permeability damage to the cores was determined as the ratio of the maximum permeability to oil after backflow to the original permeability to oil. This ratio could be computed for various portions of the core through use of the observed pressure drops.

Results

Figs. 1, 2, and 3 show the typical permeability impairments detected in various sections of cores exposed to clay-water mud, water-base emulsion mud, and oil-base mud, respectively. Effect of this time of exposure on the degree of impairment is indicated in the same bar graphs.

It may be noted that permeability

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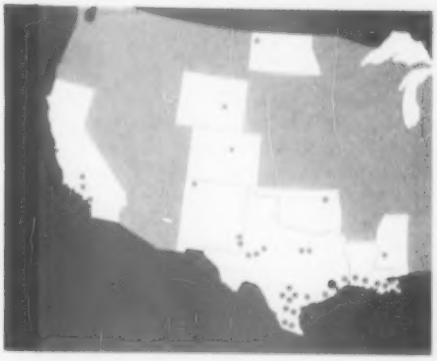

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impairment of the 0-to-2-in. section of core occurred at a shorter exposure time for cores exposed to the water-base muds (both clay-water and water-base emulsion) than for those exposed to the oil-base mud. However, with oil-base mud, the rate of impairment in this zone was greater and the recovery of the original permeability following 5 days' exposure was lower. For example, in the tests with oil-base mud, no permeability damage was indicated in the 0-to-2-in. zone after 6 hours' exposure, but the ultimate recovery of permeability after a 5-day test was about 22 per cent. In the tests with the clay-water mud, the ultimate recovery of permeability in the same section of a comparable core was about 75 per cent after 6 hours and about 35 per cent after 5 days.

Water-base damages deeper . . . It will also be noted that, in the tests with the water-base muds, penetration of the permeability damage was found to increase with time of exposure. Thus at 6 hours the penetration is shown to be about 2 in., at 1 day 6 to 10 in., and at 5 days 12 in. or more. For tests with oil-base mud, the penetration of permeability impairment was confined to the 0-to-2-in. section of core. As a result, the increase in depth of penetration with time could not be observed.

It may also be seen from these figures that in any given section of core in which permeability damage was observed, the degree of damage increased as the time of exposure increased.

In general, it has been found in a large number of tests that the degree of impairment and the depth of penetration of the impairment are usually similar in sandstone cores exposed to drilling fluids which have the same type of filtrate. For example, with clay-water mud and with emulsion mud, the degree of permeability impairment in a given section and the depth of invasion at a given time are not found significantly different.

Over-all damage . . . Fig. 4 shows average permeability impairment of the whole 12-in. length of core. The values are averages of a large number of tests and provide a means of comparing over-all results obtained with each type of mud. The data indicate the ultimate recovery of permeability to oil after cleanup to be about 55, 40, and 40 per cent for cores exposed to the oil-base, clay-water, and emulsion muds, respectively.

The values, as well as those shown previously for penetration of damage, are believed to be representative for the muds investigated but some variations are possible for particular muds. For example, certain oil-base muds have been found to cause comparatively little damage to cores, even for long exposure times.

A method for relating data on the linear cores to productivity damage in a radial system has been discussed in another paper by the authors.[2]

The data presented here demonstrate the importance of selecting an adequate core length and simulating representative drilling times in making laboratory studies of mud damage. For example, if short (say 2-in.-long) cores had been used for the tests, at short exposure times the data would have indicated greater permeability impairment for cores exposed to water-base mud than for those exposed to oil-base mud. At long exposure times, however, the data would have indicated greater permeability impairment for cores exposed to oil-base mud than for those exposed to water-base mud. The proper interpretation of such results in a radial well system would not be possible.

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What operators are doing to cope with those

Deep-Salt Headaches in East Texas

by Charles P. Lawhon and Jay P. Simpson

DEEP salt drilling in East Texas has been hampered by the movement of salt into the hole as it is drilled. Other problems are caused by interbedded anhydrite, shale, and sand. These problems require careful control of the mud program and drilling procedure.

In cases where mud weight must be kept low because of lost-circulation conditions, the following procedure has been found successful in drilling the salt:

1. Drill down one joint of pipe with a high mud-circulating rate. Bit probably cannot be picked up without sticking.

2. Pump slug of fresh water down pipe and work pipe as water flows out of the bit.

3. When bit works free, reverse out water using reverse circulating head.

Another possible solution to the drilling problem which may minimize bit sticking appears to be the use of high-density low-filtrate-loss salt muds. This practice will require casing to be set on top of the salt to prevent loss of circulation.

DEEP exploratory drilling in the East Texas area has been greatly hampered and often stopped after penetrating the salt. Operators drilling in the salt have found, generally, that they are unable to avoid sticking pipe repeatedly, unable to recover pipe or tools lost in the hole, and unable to set casing through the salt to permit drilling of the formation below.

These difficulties are believed by many to be caused by shifting or flowing of the salt under the high temperatures and pressures existing at the great depths. In most instances the salt has been found to be interbedded with anhydrite, shale, and sand. Certainly this interbedding contributes to the problem of removing cuttings, avoiding cavings, and otherwise maintaining a clean hole. Such interbedding probably is responsible to a great extent for the contrast between the difficulties in East Texas and the relative ease of drilling deep salt in South Louisiana.[1]

Muds are important . . . Mud control for drilling under the conditions described for East Texas is quite complex if a near-gage hole is to be drilled. A mud containing sufficient salt to re-

Authors are with Baroid Sales Division, National Lead Co., Houston.

DRILLING

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main saturated at bottom-hole temperatures is required to avoid solution of salt from the formation.[2] The interbedding of shale requires a mud with very low filtration rate, maintenance of which is complicated by the calcium and magnesium from the anhydrite and other salts that are usually present. To remove cuttings and support formations drilled, a weighted mud is probably justified. The solids added to increase the mud weight increase the problem of viscosity and gel control.

Some engineers believe that a complex mud program, requiring careful planning and good supervision, would be unnecessary if fresh water were pumped down to dissolve the salt while drilling. In addition to possible hole enlargement, this alternative is unattractive because of the almost insurmountable problem of disposal of the salt solution that would be returned from the well while drilling any appreciable thickness of salt.

Experiments tried . . . In planning exploratory wells in East Texas, operators have carefully considered the problem of drilling the deep salt. They have sought the best drilling techniques, the most efficient type of bit, the best mud circulation rate and the best type of mud for the job. Some well histories of the area point out the experimentation that has been carried out in actual drilling operations.

In the fall of 1952, several months were spent exploring the use of diamond and rock bits while drilling salt on well No. 1 First National Bank of Kerens, Kerens field, Navarro County, Texas. A high-density saturated salt mud was used as the drilling fluid. The salt was penetrated at 11,705 ft. and a total of 1,357 ft. was drilled before the hole was plugged and upper formation tested. Frequent sticking of the bit occurred. Mud properties varied widely. The operators blamed some of the problems on the accumulation of solids in the mud due to bypassing the shale shaker.

Salt drilled through . . . In late 1953, salt was penetrated at 12,482 ft. on the 1 Dunn in the Whelan field area of Harrison County, Texas. About 1,500 ft. of salt was drilled before drilling back into sand, shale, and anhydrite. An 8¾-in. hole was drilled through the salt section using rock bits and a high-density salt emulsion mud. Drilling and fishing in the salt took about 4 months. The total depth reached was 14,284 ft., 380 ft. below the salt.

Another successful penetration of the salt was made in the spring of 1954 when the 1 Lula Bell Strickland in Shelby County, Texas, was drilled. Massive salt was encountered at 11,558 ft. and approximately 90 ft. was drilled. Stringers of salt and anhydrite were evident until an altered igneous material was drilled at 11,715 ft. When the well was abandoned the operator was still in the altered igneous material and had reachd a depth of 12,533 ft. A low-density salt emulsion mud was used.

In the early summer of 1955, an attempt was made to explore below the salt when the 1 Allison in Carthage field, Panola County, Texas, was drilled. Salt was found interbedded with shale, sand, and anhydrite at 11,134 ft. A low-density salt emulsion mud was used in drilling to a total depth of 11,443 ft. Varying the drilling rate and circulating to pump the cuttings up the hole failed to prevent the pipe from sticking. The hole was plugged back for testing.

Most recent effort . . . Latest operator to penetrate the salt was Alfred C. Glassell, Jr. The well, 27 Carthage Gas Unit, was drilled in Carthage field of Panola County, Texas, in the fall of 1955. Although the initial attempt to drill through the salt was not successful, some of the practices followed may prove helpful in future drilling and thus deserve discussion in some detail.

The salt was encountered at 11,231 ft. and 971 ft. was drilled in less than 2 weeks. Although the pipe became stuck each time the kelly was drilled down and water had to be spotted, spotting the water did not require excessive rig time because of the installation of a reverse circulating head in the string. The circulating head also kept to a minimum dilution of the drilling mud. The drilling technique used on this well is discussed in another section.

The bits used were of the OWS rock-bit type, modified by cutting out the nozzles so that the bit openings were approximately equal to the inside area of drill pipe. This modified bit proved satisfactory.

Major difficulty in the Glassell operation was in keeping the hole clean. Increase in mud weight would have improved this condition but the mud density could be raised only to 12 lb. per gallon before formations above the salt began taking mud. Casing had been set at 6,725 ft.

Peparation of mud . . . A salt-emulsion mud was prepared 2 weeks before the salt was encountered in the Glassell well. To mix the salt mud a separate pump and a 200-bbl. mixing tank were set up. A sufficient amount of mud (1,500 bbl.) to replace the lime mud in the circulation system was prepared batchwise and pumped into storage tanks. The salt-emulsion mud was prepared by adding 125 lb. of salt, 20 lb. of Zeogel, 4 lb. of Baroco, 14 lb. of Impermex, and 0.5 lb. of Impermex preservative, 0.25 lb. of Driscose, and 0.15 bbl. of diesel oil to each barrel of water. Baroid was added to bring the mud weight to 10.4 lb. per gallon. The Impermex preservative was used to insure against spoilage of the mud in storage. Protection was also desired for

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the mud that would become diluted while drilling because of water added to free stuck pipe.

Typical properties of the mud when first prepared are given in Table 1.

Surface circulating system . . . One piece of equipment not ordinarily used while drilling salt, a reverse circulating head, was used for the Glassell well. This piece of equipment, used in conjunction with a Baroid pump-stroke counter, permitted rapid spotting of water in freeing the stuck pipe. Other components of the surface circulating system included three steel pits (combined capacity of 600 bbl.) and two mud pumps (7¼-in. liner and 20-in. stroke). Auxiliary circulating equipment included a battery of storage tanks used for water, oil and mud that could be connected into the system as desired.

Drilling procedures . . . While drilling the first 300 ft. of salt, various procedures were followed in attempting to make hole with a minimum of lost time due to stuck pipe, while at the same time insuring that the pipe could be moved through the drilled hole. The drilling rate was varied from 1 to 15 minutes to the foot. After drilling a few feet, the pipe was picked up to see if the bit could be pulled through the drilled section. If the pipe was stuck, water was spotted to free it. After several days it was determined that the bit could be drilled down with no difficulty, but could not be picked up without spotting water.

TABLE 1
Composition and Properties of Salt Mud When First Prepared for 27 Carthage Gas Unit Well

Mud properties:	
Weight, lb. per gal.	10.4
Viscosity, A.P.I., sec.	90
Viscosity, cp.	91
Initial gel, g.	0
10 min gel, g.	15
pH	6.5
Filtrate loss, A.P.I., ml.	0.5
Cake, 32nd inch	1
Filarate loss, 200° F., 500 psi., ml.	4.8
Plastic viscosity, cp.	55
Yield point, lb. per 100 sq. ft.	48
Filtrate composition:	
Calcium, e.p.m.	66
Magnesium, e.p.m.	0
Sulfate, e.p.m	22
Chloride, p.p.m.	168,000
Mud composition:	
Water, per cent by volume	71
Oil, per cent by volume	15
Salt, per cent by volume	8
Solids, per cent by volume	6
Solids, per cent by weight	16
Avg. sp. gr. Solids	3.3

Drilling Muds

As a result of this experimentation, the following technique was established and used to drill from 11,550 to 12,200 ft.:

1. Drill 28 ft. (1 to 5 minutes to the foot) with 1,700 psi. pump pressure and a circulating rate of 11 bbl. per minute.
2. Start 85 bbl. of fresh water in the drill pipe and note the reading of the pump-stroke counter.
3. Drill kelly down while water is being displaced to the bit.
4. Pick up and work pipe while pumping water out the bit. Pipe would be stuck but would usually be free after about 65 bbl. of water had passed the bit.
5. Pick up pipe two or three times while the remaining water is pumped out of the drill pipe.
6. Reverse the water out, using the reverse circulating head, then make connection. Time required for reversing out and making connection was 75 to 90 minutes. At reversing pressures over 700 psi., mud would be lost. The chloride content of the water reversed out ranged from 160,000 to 200,000 p.p.m. chloride. A small amount of salt cuttings would also be reversed out with the water.

Maintenance of mud . . . The mud properties (viscosity, gels, and filtrate) were easily controlled by daily treatments. Mud materials used were Zeogel, Impermex, Impermex preservative, salt, and lost-circulation materials. The usual daily treatment consisted of 1.5 lb. of Impermex, 5 lb. salt, and 3 lb. of

TABLE 2
Composition and Properties of Salt Mud After Drilling 500 Ft., 27 Carthage Gas Unit Well

Mud properties	
Weight, lb. per gal.	10.2
Viscosity, A.P.I., sec.	85
Viscosity, cp.	71
Initial gel, g.	0
10 min gel, g.	10
pH	7.6
Filtrate loss, A.P.I., ml.	0.5
Cake, 32nd inch	1
Filtrate loss, 200° F., 500 psi., ml.	4.6
Plastic viscosity, cp.	49
Yield point, lb. per sq. ft.	30
Filtrate composition:	
Calcium, e.p.m.	64
Magnesium, e.p.m.	6
Sulfate, e.p.m.	36
Chloride, p.p.m.	183,000
Mud composition:	
Water, per cent by volume	65
Oil, per cent by volume	16
Salt, per cent by volume	8
Solids, per cent by volume	11
Solids, per cent by weight	19
Avg. sp. gr. solids	2.1

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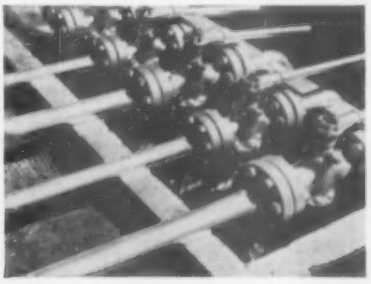

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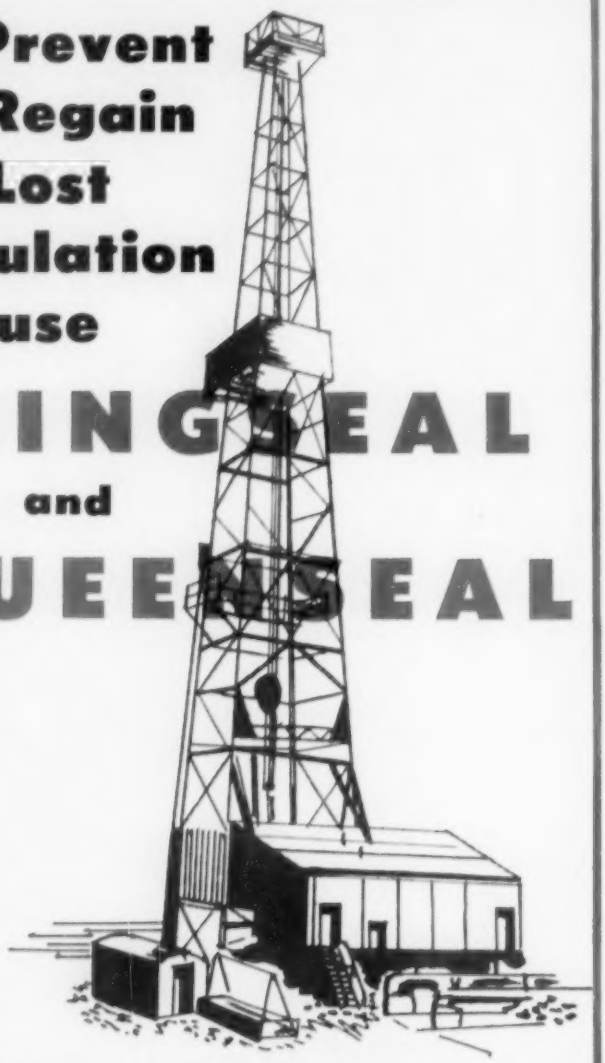

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The excellent stability of the mud is evident when these properties are compared with those of the mud when first prepared as shown in Table 1. Such careful mud control can be attributed to close cooperation among the operating personnel, the drilling crews who handled the mud, the service engineers who supervised the mud, and the laboratory engineers (manning a mobile field laboratory that was set up on the location) who advised on the treatment of the mud.

Suggested procedures . . . Review of Glassell's operations as well as other similar efforts suggests that successful drilling of the deep salt sections in the East Texas area in the future will be largely contingent upon: selection of proper equipment, with special attention given to the types of bits and to dependable pumps of ample capacity; good drilling practices; and careful control of mud properties, especially mud weight, viscosity, and filtration rate.

Until the drilling problem is more thoroughly understood, past experience indicates that casing should be set on top of the salt. This program would afford the operator an opportunity to weight up the mud in order to obtain more carrying capacity and thereby more effective removal of cuttings from the hole. The weighted mud would give better support to the walls of the hole, lessening the danger of the hole filling and preventing successful casing of the salt section.

Drilling rates do not appear to be critical if the pump capacity is ample and the cuttings are circulated up the hole prior to making a connection. Removal of cuttings seems to be simpler when a rock bit is used rather than a diamond bit.

The use of high-density, low-filtrate-loss salt muds should minimize hole problems. A reverse circulating head in the string, however, will prove beneficial if water has to be spotted to free the bit. In addition to avoiding unnecessary dilution of the mud, reversing out the water will protect exposed salt formations from excessive dissolving of salt.

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BOOKS

BALL-BEARING MAINTENANCE. By Johnny Riddle. Published by University of Oklahoma Press, Norman. pp. 170, $6.

This book provides a valuable aid to the user of ball bearings. Designed to help the user understand the basic principles of ball-bearing maintenance, its 10 chapters explain the basic ball-bearing types and provides a thorough study of bearing failures and a technical analysis of why bearings fail.

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A.S.T.M. STANDARDS ON PLASTICS. Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3. 790 pp. $5.75.

This book presents A.S.T.M. standards and tentative specifications, methods of analysis and physical testing, recommended practices, and definitions of terms pertaining to plastics. It has been substantially revised since the previous edition was published in May 1954.

Of the total of 143 specifications and tests included in this edition, 4 are entirely new and 41 have been either revised, reaffirmed, or advanced from tentative status to standard. Two others have been discontinued, one has been replaced, and another has been redesignated as a general method applicable to materials other than plastics.

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STRUCTURAL GEOLOGY FOR PETROLEUM GEOLOGISTS. By William L. Russell. Published by McGraw-Hill Book Co., Inc., 330 W. Forty-second Street, New York 36. 427 pp., $7.50.

Designed to give petroleum geologists and students the structural knowledge they'll need in their work, this book stresses the relationship of structural geology to stratigraphy. Its text is concentrated on the structural knowledge that will prove most useful to the working petroleum geologist, whether or not it is usually thought of in conjunction with oil geology.

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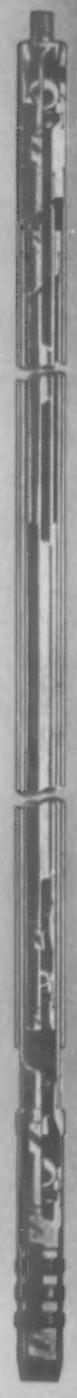

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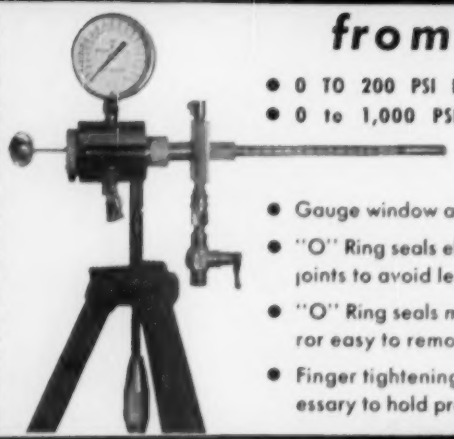

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Spread or Sensitivity of Gasolines

What is the importance of having two kinds of octane number tests? Our gasoline has a high research octane number but the motor octane number is said to be too low.—V.H.K.

Laboratory octane tests do not faithfully indicate all of the road conditions that are encountered in all of the types of engines that are driven by drivers who ask different types of performance from their cars. Valve-in-head engines tend to knock at slow speeds whereas L-head engines tend to knock at high speeds. It is therefore necessary in supplying the general public to offer both performances in one fuel, i.e., to have both a high motor octane number (73 to 80) and a high research octane number (88 to 95). In general, a high motor octane number indicates good high-speed performance, whereas a high research octane fuel is better for city driving where the speed is lower and there are frequent accelerations. Motor-method tests check best with high-speed road performance and research-method tests check best with urban-driving conditions.

As indicated in Table 1, thermally cracked, thermally reformed and poly gasolines exhibit a good low-engine-speed performance because they have a relatively high research octane number. The aromatic hydrocarbons are especially desirable in imparting such characteristics. At the other extreme, catalytically cracked or reformed gasolines and straightrun gasolines of high octane number, impart good high-speed performance. Tetraethyl lead is most useful in raising the motor octane number of straightrun and desulfurized fuels, and hence it is also a means of imparting high-speed performance. Table 1 is based in part upon the study of R. E. Maples (Pet. Refiner, September 1954, page 284).

TABLE 1—AVERAGE RELATIONSHIP BETWEEN MOTOR AND RESEARCH OCTANE NUMBERS (SENSITIVITY OR SPREAD)

	Research method											
	Straight-run		Reformed (cata.)		Reformed (thermal)		Thermal cracked		Catalytic cracked		Polymer (cata.)	
Motor method*	Clear	3 cc. TEL	Clear	3 cc. TEL	Clear	3 cc. TEL	Clear	3 cc. TEL	Clear	3 cc. TEL	Clear	3 cc. TEL
30	†30.5	†30.0										
35	36.0	†35.0										
40	41.5	40.5										
42	43.5	42.5										
44	46.0	44.5										
46	48.0	46.5	†46.0		†47.5							
48	50.5	48.5	49.0		50.0							
50	52.5	50.5	51.5		52.5							
52	55.0	52.5	54.0		55.0							
54	57.0	54.5	56.0		57.5							
56	59.5	56.5	58.5		60.5							
58	61.5	58.5	61.0		63.0							
60	64.0	60.5	63.5		65.5		†66.5					
62	66.0	62.5	65.5		68.0		69.0					
64	68.5	64.5	68.0		70.5	†63.5	71.5					
66	70.5	67.0	70.5	†66.0	73.5	66.0	75.0					
68	73.0	69.0	73.0	†69.0	76.0	69.0	78.0					
70	75.0	71.0	75.5	71.5	78.5	72.5	82.0	†73.5	†78.5			
72	77.0	73.0	78.0	74.0	81.0	75.5	84.5	76.5	81.0			
74	79.0	75.0	80.0	76.5	83.5	78.5	86.5	79.5	83.5	†81.0		
76	†81.5	77.0	82.5	79.5	86.5	82.0	89.0	82.5	86.5	84.0	†91.0	
78	†83.5	79.0	85.0	82.0	89.0	84.5	†91.5	85.0	89.0	86.5	92.0	
80		81.0	87.5	85.0	†91.5	87.5		88.0	91.5	89.0	93.0	†93.0
82		83.0	90.0	87.5		90.5		91.0	94.0	91.5	96.0	95.0
84		85.0	92.5	90.0		93.5		†94.0	†96.5	95.0	†99.0	97.0
86		87.0	95.0	93.0		97.0				97.0		†98.0
88		89.0	97.5	95.5		†100.0				†100.0		
90		91.0	100.0	98.0								

*Clear or with 3 cc. TEL (as applicable). Used as "clear" motor method with the "clear" research octane numbers, and as "leaded" with the "leaded" columns †Extrapolated. Such extreme octane numbers are seldom encountered.

Cloud Point of Dark Oils

Is there some method of determining the cloud point of dark-colored materials?—Wm. P.L.

Cloud point should not be included in the specifications of materials that may also have a dark color. However, this situation is sometimes encountered and in such cases it should be possible to locate the cloud point or freezing point by means of viscosity determinations determined at a range of temperatures in the range of the cloud point. Dr. Y. C. Young in the May 31 and June 7, 1951, issues of the Refiner's Notebook (second series) in The Oil and Gas Journal, describes in detail how to apply such a method to dark diesel oils. His procedure seems to check cloud points determined by the customary test method.

Short-Cut to Estimating Reciprocating Pump Rate

We appreciate your short-cut method of estimating pump horsepower. Have you a simple short-cut method for pump capacity?—D.L.V.

For regular duplex double-acting reciprocating steam pumps, the capacity (g.p.m.) is about equal to half of the product of the stroke (inches) and the square of the cylinder diameter (inches). Simplex pumps obviously handle about half as much. Finally, belt or gear-driven pumps have a capacity about 1½ times that of steam-driven pumps.

As an example, the capacity of a 6 by 4 by 6 general-service duplex pump is about half of 6 times 4 square or 48 g.p.m. Had it been a simplex pump, the capacity would have been about 24 g.p.m., or for a gear-driven pump about 72 g.p.m.

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IMPROVING DISTILLATE FUELS—2

How to Determine Gel Deposition

by J. P. Kirchner, D. P. Osterhout, and W. R. Schwindeman

FORMATION of sludge in distillate fuels was dealt with in Installment 1. An entirely different problem is the formation of gel-like deposits due to the interaction of mercaptans in the fuel with the copper in **brass** parts of the fuel system.

This gel is not soluble in any conventional solvent and thus presents a severe service problem. It can only be removed from the burner and fuel system by tearing down the unit and hand cleaning. If this is not done, small pieces of gel migrate through the system from uncleaned areas, plug the nozzle or other sensitive points, and again shut down the unit.

Composition . . . Analyses of these deposits showed that they are essentially a grease composed of fuel oil with small amounts of copper mercaptides as the soap or gelling agent. Traces of water and oxygenated material were also present. As noted later, water is necessary to the formation of these deposits. Detailed analysis of a gel deposit is given in Table 1.

Laboratory Test

A laboratory test has been developed to simulate field operation. In this test, gel is produced from No. 2 fuel by circulating it through a brass filter for a period of 2 weeks. At the end of that time, the test filter is analyzed for the weight of copper mercaptide present. This is done by converting the copper mercaptide formed on the filter to mercaptan with acid and titrating the mercaptan. The result of the test is reported (in micrograms of sulfur) as mercaptan present on the filter. Extremely precise micro techniques were evolved to make this measurement, which is accurate to plus or minus 3 micrograms (0.000003 g.). A schematic diagram of the test rig is given in Fig. 2.

Authors are with Socony Mobil Oil Co., Inc., Paulsboro, N. J. From paper presented at A.S.M.E. meeting, Chicago.

Mercaptans are worst . . . Using this test, it has been demonstrated that mercaptans are the causative agent in gel formation, and that the amount of gel formed is directly related to the amount of mercaptan in the fuel. In doing this work, the following significant points were developed:

1. All mercaptans found in No. 2 fuel form copper mercaptide (and gel) under the proper conditions (Table 2).

2. Disulfides do not form gel at normal operating temperatures.

3. Weight for weight, the mercaptans in cracked fuel are by far the worst offenders in gel formation (Table 3).

4. The greatest quantities of gel are formed from mixtures of catalytic and straightrun mercaptans. That is, mixtures of straightrun and catalytic fuel form more gel than would be expected from the gel-forming tendency of the component stocks. This is demonstrated in Table 4 where all of the blends gave gel numbers at least twice as high as calculated from the gel numbers of the individual stocks.

This effect can also be produced by adding thiocresol type mercaptans to straightrun fuel.

TABLE 1—ANALYSIS OF GEL DEPOSIT

Fuel, weight per cent	95.0
Copper mercaptide, weight per cent	1.8
Oxygenated compounds, weight per cent	2.2
Water, weight per cent	1.0
Empirical formulas:	
Copper mercaptide	$C_{12}H_{21}$–S–Cu
Oxygenated compounds	$C_{20}H_{37}$COOH

TABLE 2—FORMATION OF GEL FROM VARIOUS TYPE STOCKS

Sample—	Micrograms of sulfur as mercaptan recovered from test filter
Straightrun naphtha (300°-400° F.)	200
Straightrun gas oil (650° F. e.p.)	200
Sour straightrun No. 2 fuel oil	300
Catalytically cracked No. 2 fuel oil	800

TABLE 3—EFFECT OF MERCAPTAN TYPE OF GEL FORMATION

Stock—	Weight per cent mercaptan sulfur	Micrograms sulfur as mercaptan recovered from test filter
Catalytically cracked distillate	.0233	1,400
Straightrun distillate	.0258	154
Catalytically cracked distillate	.0264	750
Straightrun distillate	.0261	100

TABLE 4—EFFECT OR BLENDING ON GEL FORMATION MICROGRAMS SULFUR AS MERCAPTAN FORMED ON TEST FILTER

Catalytically cracked distillate	Straight-run distillate	Blend* (calculated)	Blend* (actual)
750	150	510	1,050
550	200	410	950
800	108	520	1,000
225	175	205	575
150	150	150	750

*60 per cent (volume) catalytically cracked distillate, 40 per cent (volume) straightrun distillate.

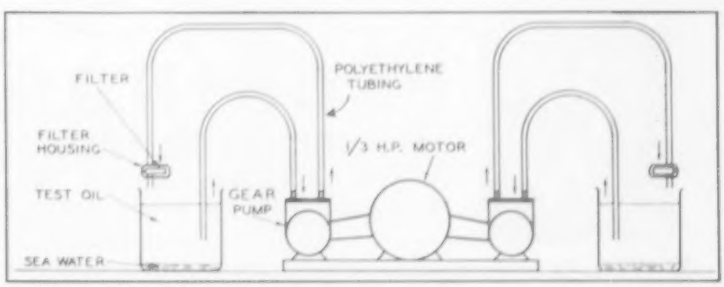

Fig. 2—Schematic diagram of gel test apparatus.

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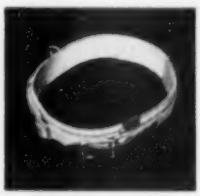

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Part 2:

Metering Pulsating Flow

. . . with differential pressure meters

THE first installment dealt with experimental metering of pulsating flow with three types of differential-pressure manometers: mercury, bellows type, and diaphragm type. The problem of damping and importance of damping valve characteristics was emphasized.

Diaphragm-type transmitter . . . For this type we see a very marked influence in the damping contribution. This is brought about entirely by the needle-valve function. In each instance, the valve definitely showed a check-valve action in favor of the receiver, which means that the pulse flowed into the receiver element easier than it flowed out. This caused the pen to move upward on the chart.

The needle valve used was a long-tapered type to minimize influence of this sort. The effect is very pronounced, and the reader should be alert to the fact that this particular component of the flow-metering system needs marked improvement under pulsating conditions.

Table 1 shows the over-all error in per cent of measured flow. Note that the mercury manometer under the 4-ft. and 17-ft.-length conditions using ¼-in. tubing exhibited a sensitivity to frequency. This is because the orifice diameter was too small for the rate of flow of fluid through the connecting piping. Increasing the orifice size would eliminate this effect.

Author is with Taylor Instrument Co., Rochester, N. Y. Complete test results and discussion were published in Taylor Technology, winter 1955 issue.

Going farther down the column, we notice that the bellows and mercury-type manometers have over-all errors of about 0.5 to 0.8 per cent. In all instances, the values are negative—which means that the instrument is reading high and the correction should be subtracted. This is in accordance with mathematical prediction, so it is not surprising that the results turned out in this fashion.

TABLE 1
Correlation of Errors With Manometer Type and Piping

Instrument type and diameter	Tubing length (ft.)	—Per cent— Damping contribution	Error measured flow
Mercury:			
¼-in.	4	0.69	—2.23 to 0.45*
	17	0.10	—1.1 to 0.24†
	42	0.0	—0.60
⅜-in.	4	0.45	—1.20
	17	0.05	—0.66
	42	0.05	—0.50
Bellows:			
¼-in.	4	0.36	—0.69
	17	0.32	—0.62
	42	0.10	—0.50
⅜-in.	4	0.42	—0.47
	17	0.22	—0.79
	42	0.61	—0.67
Diaphragm:			
¼-in.	4	1.5	—0.71
	17	0.87	—0.38
	42	0.75	—0.43
⅜-in.	4	1.6	—0.64
	17	1.6	—0.84
	42	0.93	—0.62

*Frequency varies from 0.03 to 1.0 cycles per second. †Frequency varies from 0.03 to 0.5 cycles per second.

Considering further the diaphragm transmitter results, we note that the general magnitude of error is no greater than the bellows or mercury type. Errors due to delayed feedback have been deliberately omitted. Only the trend values are shown in order to eliminate the particular brand of transmitter.

Very long taper . . . To get true average damping, the damping valve coefficent must be the same in forward and reverse flow. Many needle valves do not exhibit this performance characteristic because of the bluntness of the needle. Actually, the needle should be a very long taper and the orifice associated with the needle should be round on both the entrance and exit faces. Superior to a needle valve, though not readily adjustable, is a length of capillary or a multiple-orifice unit. Our tests reveal that the actual pen shift, because of damping, many times amounted to 1½ per cent—an unnecessary error because adequate design can overcome the problem.

Table 1 summarizes the results of damping. Considering the mercury and bellows-type instruments, the damping contribution to the error is relatively small. The plus sign indicates the contribution made by the damping device moved the pen towards the higher flow position. There is quite an erratic distribution of values, so that no specific rule can be formulated. All that can be said is that the errors run about ½ of 1 per cent or less and fall within the reproducibility of the orifice coefficient.

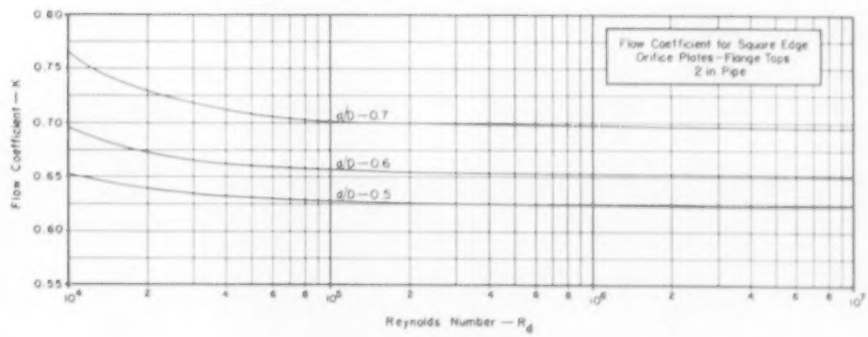

FIG. 2—These curves show how orifice coefficient varies with Reynolds Number. For this test, the Reynolds Number band was of such that the coefficient was constant. However, if the orifice plate were to operate in the region of curvative and the flow were pulsating, then the differential would change not only because of pulsation but also because of the variation of the coefficient.

by W. L. Nelson
Technical Editor

COST-imating

6. Costs of Alloy Steel and Clad Vessels and Tanks

TABLE 1 indicates the costs of alloy vessels in relation to the cost of the carbon-steel vessels of Cost-imating No. 5 (January 23, 1956). The same ratios probably apply reasonably accurately to the costs of small tanks (Cost-imating No. 3, December 5, 1955) and they apply to the shells of fractionating towers (see Cost-imating No. 7 in the February 20 issue). The use of the data of Cost-imating No. 5 and of Table 1 can best be explained by an example.

Example . . . Consider a 10-ft.-diameter carbon-steel vessel that is ½ in. thick and 32 ft. long between heads. It has ⅝-in. dished heads and the numerous connections shown in the following computations (see tables of Cost-imating No. 5 of January 23, 1956).

COST INDEXES OF ALLOY STEELS AND SPECIAL METALS

	Stainless, bars		Alloy bars					Carbon steel plate
	Type 430*	Types 303 and 304*	Type 3120	Copper ingot	Nickel cathod	Zinc slab	Red brass	
1946	100	100	100	100	100	100	100	100
1947	112	108	120	151	111	120		117
1948	121	112	136	158	116	155	130	140
1949			150	137	127	140		135
1950			156	153	143	159		136
1951	169		165	174	171	205		156
1952	147	168	196	174	161	186	187	153
1953	157	179	220	206	171	126	179	150
1954	161	183	230	212	163	122	185	147
1955 est.	172	193	241	240	173	136	250	154

*Correspond to prices during 1946 of 18 cents per pound for 403 slab and 23 cents per pound for 303 bars.

freight, etc., would be about 230 per cent more (see Table 1 herein):

$5,180 \times 3.30 = \$17,100$ (1946)
and $17,100 \times 1.93 = \$33,900$ (1955)

	Mat. and labor — 1946 costs	Mat. and labor — 1955 costs*
One shell, ½ in., 32 × 641 = 20,510 lb. (Table 2)		
Two heads, ⅝ in. 4,847 (Table 2)		
25,537 lb. at 14 cents per pound	$3,575	$ 5,720
Four ¾-in. couplings at 2.35 (Table 4)	9	17
Two 1½-in. couplings at 3.60 (Table 4)	7	13
Two 18-in. manholes, 300 lb. at about 300 (Table 3)	600	1,050
One 30-in. manhole, 300 lb. at about 665 (Table 3)	665	1,160
One 10-in. nozzle, 300 lb. at about 105 (Table 3)	105	184
Four 4-in. nozzles, at about 39 (Table 3)	156	272
Three 2-in. nozzles, at about 23 (Table 3)	69	121
One erection job at about 850 (Table 2)	850	1,615
One freight on 15 tons for 640 miles at 2.5 cents per ton (Table 2)	240	360
	$6,276	$10,512
One job stress relieving if required, at 1 per cent (Table 2)	63	105
One X-ray inspection, if required, at 3 per cent (Table 2)	195	330
Approximate cost	$6,534	$10,947

*Approximate.

If a steel containing 18 per cent chromium and 8 per cent nickel (A.I.S.I. 304) were used, the cost of the vessel without erection and and the total cost of the vessel would be increased proportionally to about $18,450 for 1946, and about $36,300 during 1955.

TABLE 1—RELATIVE COST OF ALLOY STEEL VESSELS, ETC. (F.O.B. SHOP)*

	A.S.T.M. No.	A.I.S.I. No.	Plate[5]	Vessels[5,6]	Nozzles[5]
Firebox quality	A-285 C		1.0	1.0	1.0
Silicon killed	A-201		1.03-1.12	1.0-1.1	
Carbon ½ Mo	A-204 A		0.92-1.41	1.2-1.4	
½ Cr ½ Mo	A-301		0.94-1.74	0.8-1.5	
4-6 Cr ½ Mo	A-200 Gr. 8	501	3.05-5.4	1.6-2.6	
11-13 Chromium	A-200 Gr. 7	410	5.6 -7.15	2.5-3.3	
16 Chromium	A-200 Gr. 7	430		3.2	
18-8 Cr Ni	A-167 Gr. 3	304	4.7 -7.7	2.5-4.0	2.9-3.1
16-13-3 Cr Ni Mo	A-167 Gr. 11c	316		5.4	3.5-3.7
18-8 Co stabilized	A-167 Gr. 6b	347	5.4 -8.5	2.7-5.0	3.2-3.4
25-20 Cr Ni	A-167 Gr. 10	310	5.8 -10.4	6.0	

*The lower values[5] are based on strength whereas the highest values[6] are for same thicknesses.

TABLE 2—APPROXIMATE CENTS PER POUND FOR COMPLETE ERECTED ALLOY STEEL VESSELS[1] (1946)

Weight (lb.)	Clad steel*	Stainless 304 or 316	Monel, nickel or inconel
10,000	47	53	57
25,000	31	35	38
50,000	23	26	28
75,000	19	21	23
150,000	16	18	19

*62-82 per cent of the cost of solid constructions of the same metal.[2]

TABLE 3—LININGS, GUNITE, ETC. (1946), $ PER SQ. FT.

	M & L
Alloy linings:	
Shell (Type 410)* 5/64 in.[1,3]	5.40-8.00
Shell (Type 410)* 7/64 in.[1,3]	5.80-8.40
Nozzles, ⅛ in., lining[1]	33.00
Nozzles, ⅛ in. facing[1]	49.00
Nozzles, ⅛ in., cover[1]	39.00
Gunite[1,3,4] (also fractionators)†	0.47
Gunite,[1] structural members	0.51
Gunite,[2] fractionator incl. removing old job	0.98
Metalizing complete,[1,4] aluminum	‡1.00-1.10
Metalizing complete,[1] lead	0.94
Metalizing complete,[1] stainless	1.90-3.00
Metalizing complete,[1] small jobs	1.50

*Kind of alloy not of great significance because labor is large. †50-60 per cent of cost of tanks.[2] ‡Labor is more than 65 per cent of cost.[1]

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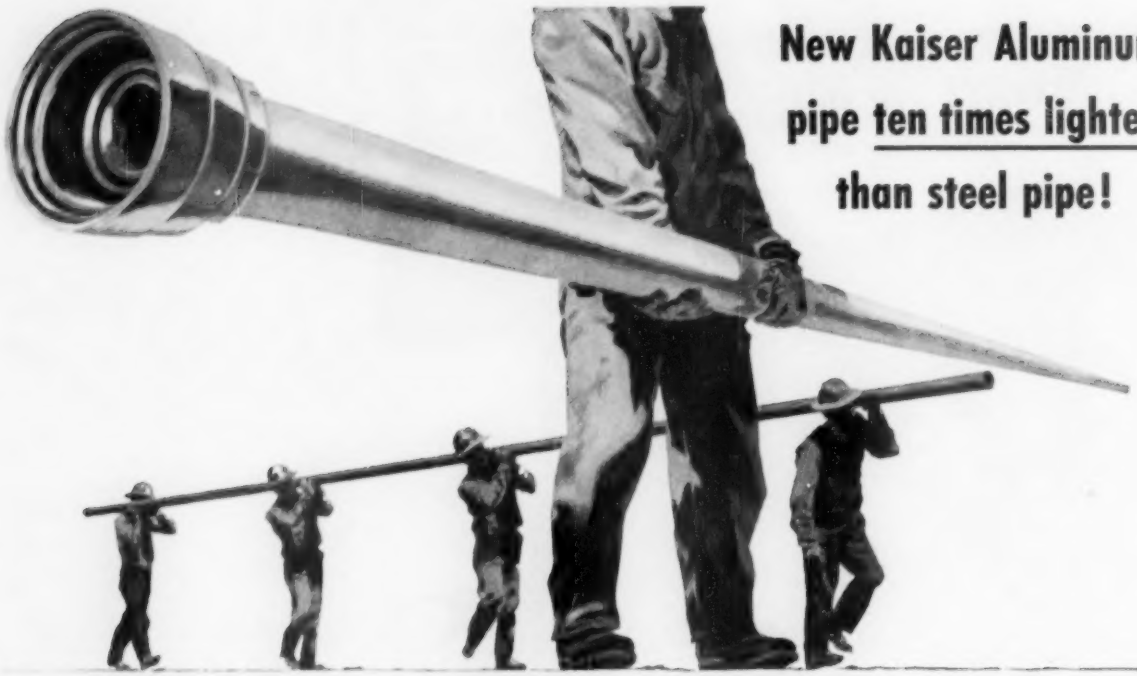


New Kaiser Aluminum pipe ten times lighter than steel pipe!

As you can see in the picture above, 25 feet of 4" steel pipe is a heavy load for four men.

But 30 feet of 4" Kaiser Aluminum pipe is *easily* handled by only one man—because Kaiser Aluminum pipe is more than ten times lighter than steel pipe.

Its light weight permits extremely fast handling, resulting in huge savings in loading, stringing and pickup . . . *savings up to $84.35 per mile for these items alone!*

And this is only *part* of the saving you get when you use the less costly Kaiser Aluminum pipe and coupler system for your supply lines. The newly developed detachable couplers speed connecting and disconnecting—give you an additional saving of $135.48 per mile!

Your nearby supplier stocks Kaiser Aluminum petroleum pipe in 30-foot lengths of 2, 3 and 4 inch diameters, with cladded inside surfaces that add extra resistance to corrosion. He also has couplers and fittings to complete your system.

For further information, contact the Kaiser Aluminum sales office listed in your telephone directory or any of the fitting manufacturers listed below. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, California.

SAVE UP TO $219 PER MILE!*

(Laying one mile of 4-inch oil rig supply pipe)

Aluminum vs. Steel

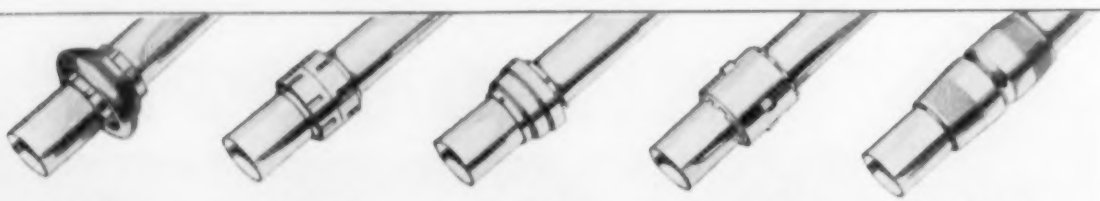
	STEEL		ALUMINUM	
OPERATION	MAN HOURS	COST	MAN HOURS	COST
Loading	10.66 @ $2.20	$ 23.46	3.25 @ $2.20	$ 7.15
Stringing (Trucker)	1.66 @ $1.82	3.03	.83 @ $1.82	1.52
(Crew)	3.33 @ $2.20	7.33	1.66 @ $2.20	3.65
Connecting	43.33 @ $2.20	$ 95.33	3.00 @ $2.20	$ 6.60
Disconnecting	26.25 @ $2.20	$ 57.75	5.00 @ $2.20	$11.00
Pick-up and reloading (Trucker)	7.25 @ $1.82	13.20	1.33 @ $1.82	2.42
(Crew)	29.00 @ $2.20	63.80	5.33 @ $2.20	11.73
Total	121.48	$263.90	20.40	$44.07

Total savings with Kaiser Aluminum pipe—$219.83!

*Figures compiled from extensive test installations by Kaiser Aluminum in Texas. Total savings could be more or slightly less, according to local conditions.

Kaiser Aluminum

setting the pace—in growth, quality and service



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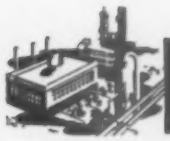

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—40

How Fluid Properties Affect Mechanical Seals

Q. What properties of fluids affect seal design?

A. Viscosity, lubricity, boiling point, acidity, alkalinity, abrasive content, sensitivity, volatility, flammability, vapor pressure specific gravity, and toxicity.

Q. What is viscosity?

A. Viscosity is a measure of the ability of a fluid to flow. Fluids that flow readily have a low viscosity and vice versa. The viscosity of fluids is usually affected by temperature —increases reduce viscosity and decreases cause higher viscosity. Some recently developed synthetic fluids change viscosity very little over a wide range of temperature change. Viscosity is often expressed in terms of S.U.s. (Saybolt Universal seconds) at x temperature.

Q. What is lubricity?

A. Lubricity is that quality in a fluid that will provide a film between two surfaces forced against each other so that they cannot actually come in direct contact. Viscosity has some bearing on this, but fluids of the same viscosity do not necessarily have the same capacity to lubricate. The term "film strength" is often used in this connection.

Q. What is meant by abrasive content?

A. Some fluids have abrasive materials in suspension. Others will produce abrasive particles when acted upon by, for instance, temperature. Abrasive particles are defined by nature and size. Particles that exceed "between-face film thickness" in size do not normally cause trouble. Very fine particles, small enough to enter between seal faces, are difficult to deal with.

Q. What is "sensitivity" in a fluid?

A. For want of a better word we have used sensitivity to indicate that property which results in a permanent change in characteristics when acted upon by external conditions such as temperature, friction, agitation, etc. Examples are: (1) latex, which will coagulate from agitation unless kept well above pH 7; (2) plastic solutions that will "set up" when subjected to elevated temperatures; (3) water that will deposit minerals when acted upon by elevated temperatures; and (4) paints, etc., that become "tacky" upon loss of solvent.

Q. What is volatility?

A. Volatility is that property of a liquid which indicates its relative ability to vaporize in relation to the temperature-pressure condition. Generally speaking, a volatile fluid will vaporize at atmospheric pressure and temperature.

Q. Flammability?

A. All volatile fluids are not flammable. For instance, carbon tetrachloride combines with oxygen to suppress combustion. Generally, however, volatile fluids are considered dangerous because they may form highly flammable mixtures.

Q. How does viscosity affect seal performance?

A. To a great extent viscosity will determine "film strength" and therefore lubricity or lubricating value. However, very high viscosities will result in very high torque conditions between the seal faces.

Q. What effect does boiling point or vapor pressure have on a seal application?

A. When handling any fluid with a relatively low boiling point, there is always the possibility of producing a vaporizing or "flash" condition between the faces due to the increased temperature caused by friction. When this condition is critical, the seal-face area must be cooled below the vaporizing temperature. When "flashing" occurs, lubricity is lost and seal wear aggravated by increased friction between faces and by erosion resulting from the action of high velocity vapors.

Q. What steps can be taken to handle acid or alkaline conditions?

A. The selection of materials that are not attacked by these materials is the only solution to corrosive applications. It is essential that the exact nature of the corrosive fluid be established for maximum results. Dilute acids are generally more destructive than the concentrated product. Therefore, the name or type of acid alone is not sufficient. Temperature is also of great importance.

Q. What method is used to combat abrasive conditions?

A. Abrasion-resistant materials should be used in the contacting faces. However, for maximum results, steps should be taken to "clean up" the fluid adjacent to the seal faces. This can be done by limiting the flow of fluid in the seal area and then providing clean fluid to this area. The clean fluid can be another fluid compatible with the product or the product itself after being passed through a filter.

To keep the volume of clean or filtered material required to a minimum in a single-seal application, the loss of clean fluid fed to the seal area should be restricted by a close clearance outlet such as the throat bushing in a centrifugal pump. In a double-seal arrangement, the loss of clean fluid from between the seals would be negligible. In either case, the clean fluid area should be at a pressure slightly in excess of the abrasive-containing fluid.

Q. What can be done about "sensitive" liquids?

A. If the liquid is sensitive to temperature, the temperature must be controlled at the seal face by "flooding," external cooling of the seal area, or both. When liquids are sensitive to agitation, seal design should allow only minimum turbulence in the liquid.

In cases where loss of solvent changes the nature of the liquid adversely, such as could happen when solvent loss is encountered from the material forming the seal-face film, it may be necessary to provide additional solvent to maintain a "solvent high" balance in this film. This can best be done by a double-seal arrangement with solvent between the seals.

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Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

PIPELINE activity as reported below by The Oil and Gas Journal is compiled from information received from pipeline companies and contracting firms.

These projects include those planned, proposed, under way, and contracted. Uncontracted projects are indicated by • preceding the job.

Crude-Oil Pipelines

• **Big Horn Pipe Line Co.**—Firm has asked Wyoming Public Service Commission for permission to build a 150-mile, 8-in. crude-oil line from Ash Creek field, Wyoming, to a connection with Service Pipe Line Co.'s line at Midwest, Wyo.

Lakehead Pipe Line Co., Inc.—Company has let 51 miles of 26-in. line to Anderson Brothers Corp., Houston. The job is expected to be completed during the summer of 1956 and is in conjunction with 69 miles of 24 and 26-in. looping that Interprovincial Pipe Line Co. will also complete next summer (see Interprovincial under Canada, also).

• **Offshore Gathering Corp.**—This Houston company has proposed to build a natural-gas and a crude-oil line to gather gas and crude in the Gulf of Mexico off Louisiana. The gas line will be comprised of 60 miles of 24-in., 70 miles of 26-in., and 234 miles of 30-in. The crude line will be mostly 20-in. Each line will be about 364 miles in length. Estimated cost of the lines is $150,000,000.

• **Sinclair Pipe Line Co.**—Company will build a 300-mile crude line form Jacksboro, Tex., to Houston. The project will cost $14,000,000 and require 3 years to complete. The 150-mile portion from Jacksboro to Mexia will be 18-in. pipe. The Mexia-Houston portion will be 20-in. River Construction Corp. has Jacksboro to Mexia project.

• **Union Oil Co. of California.**—Company proposes to build an 815-mile line from Rifle, Colo., to Los Angeles to carry the products from its proposed Rifle, Colo., shale-oil plant to the Los Angeles refining area. The line would cost approximately $56,000,000.

• **U. S. Defense Department.** — Defense officials are considering a 97-mile, $8,000,000 line from the Elk Hills Naval Reserve in California to the Los Angeles refining area.

• **West Coast Pipeline Co.**—The off-again-on-again plans for this crude line from near Wink in West Texas to near Norwalk in California are presently before the Office of Defense Mobilization. A three-man board of nonindustry members has recommended that the project be dropped. They questioned the ability of West Texas to produce enough crude to supply both the East and West Coasts in time of war. The three-man board favored building a line from California's Elk Hills Naval Reserve to be held in standby for possible future need.

Products Pipelines

• **American Pipe Line Co.**—Has received ODM approval to amortize 40 per cent of $178,000,000 with a rapid writeoff on proposed line to run from Gulf Coast area to New York City area.

• **H. W. Bass & Sons, Inc.**—Company is planning on a 152-mile, 4-6-in. L.P.G. line from Goliad Corp.'s plant in Live Oak County, Texas, to Corpus Christi.

Cosden Petroleum Corp.—Company is building 100 miles of 6-in. line from its refinery at Big Spring to Abilene, Tex. C. O. Holder Construction Co., of Snyder, Tex., has contract.

• **El Paso Natural Gas Co.**—Firm has disclosed plans to build a 240-mile, "larger than 6-in." line from the Permian basin to El Paso. The line will start in the vicinity of the firm's Midkiff natural-gasoline plant in Midland County, Texas. The new line will carry natural gasoline, butane, and propane.

• **Gulf Refining Co.**—Firm will build a 45-mile, 8-in. products line from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss., to a connection with Plantation Pipe Line Co.'s system. The refinery isn't due on stream until May 1957, and no definite time has been set for start of laying the line.

• **International Pipe Line, Inc.**—132 miles 8-in., proposed, Wrenshall to Minneapolis, Minn. Cost $4,200,000.

• **Phillips Chemical Co.**—Firm plans a 50-mile, 4-in. ethylene line from Sweeny, Tex., to Port Adams, Tex. The estimated date of completion is set for October 1, 1956.

• **Phillips Pipe Line Co.**—Firm plans 64-mile, 12-in. products line from Sweeny to Houston. Completion set for April 1956.

Plantation Pipe Line Co.—Firm will spend $23,500,000 in 1956 to expand its system from Baton Rouge, La., to Greensboro, N. C. The company will lay 327 miles of 18-in. from Baton Rouge to just south of Birmingham at Helena, Ala. The new line will increase capacity from 245,000 bbl. daily to 304,000 bbl.

• **Sioux Oil Co.**—Firm plans to build 80-mile, 4½-in. line from its Newcastle, Wyo., refinery to Rapid City, S. D. The line is slated for completion in late 1956.

Southern Pacific Pipe Line Corp.—Firm has let an 87-mile, 6-in. products line from its main line at Phoenix to Davis Monathan Air Force Base. Engineers Limited Pipeline Co., of San Francisco has the job. Firm has also let a 76-mile, 6-in. project from near Phoenix to Luke Air Force Base. Hood Construction Co., of Lynwood, Calif., has the job. A 14-mile, 6-in. line from Colton, Calif., to March Air Force Base will be let later.

• **Sun Pipe Line Co.**—Firm will build 110 miles of 14-in. from Twin Oaks, Pa., to Newark. The line will have a 83,000-bbl. capacity and will replace an existing 8-in. line. September 15, 1956, is expected completion date.

• **Sunflower Pipe Line System.**—Company proposes to build a 215-mile, 6-in. line to transport L.P.G. from six counties in western Kansas to Wichita. Application approved by Kansas Corporation Commission.

• **Tennessee Gas Transmission Co.**—Firm has announced plans for a 200-mile butane line from its natural-gasoline plant west of Corpus Christi, Tex., to the Houston area. The butane will be sold to Petro-Tex Chemical Corp., which operates one of the nation's largest butadiene plants here.

Texas Eastern Transmission Corp.—Company has received Federal Power Commission approval to abandon the "Little Inch" gas line and to convert it to products service. The company will spend $13,000,000 converting the line back to products. When finished the line will have a capacity of 235,000 bbl. daily.

Non-Petroleum Pipelines

American Gilsonite Co.—Company has announced plans for a 100-mile pipeline from near Bonanza, Utah, to a proposed gilsonite refinery in western Colorado. The company, owned by Barber Oil Corp. and Standard Oil Co. of California, plans to make gasoline and coke by refining gilsonite. The gilsonite would be moved in a slurry.

Pittsburgh Consolidation Coal Co.—This firm has announced plans for the first pipeline to move coal. The line will be 108 miles of 10-in. from the company's Georgetown mines in eastern Ohio to Cleveland Electric Illuminating Co.'s Eastlake power plant northeast of Cleveland. Ford, Bacon & Davis, Inc., will issue specifications, let contracts, and supervise the construction work. Willims Bros. has contract and has shut down for the winter.

• **Arkansas Louisiana Gas Co.**—Firm has announced long-range plans to build a $50,000,000 pipeline from the Texas-Louisiana coastal region to northern Louisiana. The line would connect with the company's present system.

Natural-Gas Pipelines

American Louisiana Pipe Line Co.—Company has let bulk of its 1,121-mile line from North Tepetate, La., to Detroit. Only a 22-m spur from Payne, Ind., to Bridgman, Mich., is still not awarded. H. C. Price Co., Bartlesville, Okla., has 783 miles of 30-in. pipe. One section will work south from the Hancock-Henry County line and the other will work north from Slaughters, Ky. Brown & Root has 221 miles of 30-in. from North Tepetate to the Louisiana-Arkansas border, and 39 miles of 16-in. line to be built under water. The firm has subcontracted the 221 miles to Associated Pipe Line Contractors and Western Contractors. It will lay the under-water line itself.

• **Carolina Pipeline Co.**—This newly organized firm has applied to the South Carolina Public Service Commission for permission to distribute natural gas in central South Carolina. The firm plans to build $8,700,000 worth of distribution lines to 14 cities. Other towns in the area without natural-gas service may be included eventually. The new firm plans to buy gas from either Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.

• **Carolina Natural Gas Corp.**—185 miles 6-12-in., proposed lateral lines off Transcontinental in North and South Carolina.

Cascade Natural Gas Co.—Firm has let contract to Engineering Construction Co., of Tulsa, for 400 miles of gas distribution lines in the State of Washington. The lines will range from ¾ to 12-in. and will be laid in the towns of Yakima, Grandview, Granger, Trosper, Sunnyside, Toppenish, Union Gap, Wahpato, and Zillah. Work will start April 1.

• **Cities of Clarendon and Marvell, Ark.**—Cities have filed for FPC permission to interconnect their facilities with Texas Gas Corp.'s line south of Helena, Ark. The cities will build 53 miles of 4, 5, and 6-in. line to transport the gas.

• **Coastal Transmission Co.** — Company plans to build 550 miles of 30-in. line from near McAllen in South Texas to near Baton Rouge (See Houston, Texas Gas & Oil Co.

• **Colonial Natural Gas Corp.**—Company proposes to build two systems, one from the Houston-Lake Charles area to Miami, Fla., and the other in the Carolinas and Georgia. Neither idea is before the FPC yet.

• **Colorado Interstate Gas Co.**—Firm com-

Pipeline Patrol

pleted 136 miles of 22-in. from Laramie, Wyo., to Denver in November. Second part of line from Laramie to Rock Springs, Wyo., will be laid in 1956. The second section will be 238 miles of 22-in. pipe and will be completed about October 1.

• **El Paso Natural Gas Co.**—Firm has received FPC permission to loop 450 miles of 34-in. line from the San Juan basin to the Colorado River at the Arizona-California border.

• **Houston Texas Gas & Oil Co.**—Company has applied to FPC for permission to lay a 960-mile gas line between Baton Rouge and Miami. The main line would consist of 507 miles of 30-in., 157 miles of 26-in., 61 miles of 20-in., 224 miles of 18-in., and 12 miles of 12-in. Company also plans 500 miles of sales laterals in Florida. Main line would join with Coastal Transmission's proposed line from McAllen to Baton Rouge.

• **Iron Ranges Natural Gas Co.**—This St. Paul company has filed an application with the FPC to build a 68-mile transmission line and 47 miles of laterals to supply various towns and cities on the Mesabi Iron Range in Minnesota.

• **Lone Star Gas Co.**—Company has two plans up before FPC to enlarge its system in Texas and Oklahoma. One is for an $18,000,000, 230-mile line from Cotton County, Oklahoma, to Fritch, Tex. The other plan is for a 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line. The company hopes to prevent Natural Gas Pipeline Co. of America from building its line from Wise County, Texas, to Fritch (see below).

• **Michigan Consolidated Gas Co.**—25 miles, 12-in., proposed, from near Sparta to Muskegon, Mich.

• **Michigan Wisconsin Pipe Line Co.**—251 miles, proposed, 24, 18, 12, 6, and 4-in. loops. Majority will be in Wisconsin.

• **Midwestern Gas Transmission Co.**—Company will build a main line from Portland, Tenn., to Canadian border near Emerson, Man., Canada. Extensions from main line to cities in Minnesota and Wisconsin are also planned. The main line will be comprised of 829 miles of 24-in., 109 miles of 16-in., and 174 miles of 12-in. The extensions will total 648 miles of 3 to 18-in. pipe. The application is now pending with the FPC.

• **Natural Gas Pipeline Co. of America**—Company now before FPC on plans to build 150 miles of 20 and 26-in. line from Wise County, East Texas, to its station 111 at Fritch, Tex.

Nevada Natural Gas Co.—Company plans looping program along its 114-mile line from Needles, Calif., to Las Vegas, Nev. Mileage and size are unknown but cost will be about $2,500,000.

• **New River Gas Co.**—50 miles, planned. Summers to Monroe counties, West Virginia to Narrows and Dublin, Va.

• **North Carolina Natural Gas Corp.**—This subsidiary of Colonial Natural Gas Corp. (formerly Texas-Ohio Gas Co.) has received permission from the North Carolina Utilities Commission to build 575 miles of gas lines in the state. The system will range in size from 3 to 16-in. and will cost about $13,000,000. The line will run from a point on Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across North Carolina. It will deliver gas to customers in a territory lying east of Charlotte and south of Lexington, Sanford, and Raleigh.

• **Northern Natural Gas Co.**—Company plans to spend $32,000,000 to add 348 miles of main line and 307 miles of branch lines in Wisconsin, Minnesota, South Dakota, and Iowa. The application is before the FPC now. The main lines include 169 miles in the Duluth-Superior area and 164 miles in the Aberdeen area of South Dakota.

• **Pacific Gas & Electric Co.**—Company's long-range plans call for looping the Topock-Milpitas line with 135 miles of 34-in. The major part of the line will be laid in 1956, while 62 miles will be laid in 1957.

Pacific Northwest Pipe Line Corp.—Firm has let its 1,446 mile gas line from the San Juan basin to Bellingham, Wash. Seven hundred miles now laid. Contractors and their sections are:

River Construction Corp., two sections totalling 150 miles of 26-in. between Ignacio, Colo., and Moab, Utah.

R. H. Fulton Co., two sections totalling 160 miles of 26-in. between Moab and Jensen, Utah.

Associated Pipeline Contractors, Inc., one section of 77.6 miles of 26-in. between Jensen and Green River, Wyo.

A. J. Curtis Construction Co., one section of 82.8 miles of 22-in. from Green River to Sage, Wyo. Completed.

B & M Construction Corp., one section of 90 miles of 22-in. between Sage and Lava Hot Springs, Idaho.

Midwestern Constructors, Inc., one section of 95 miles of 22-in. from Hot Springs to Burley, Idaho.

H. B. Zachry Co., San Antonio, sections 9 and 10, 214 miles of 22-in. between Burley and Payette, Idaho.

Fulghum Construction Co., Harrisburg, Pa., sections 11 and 12, 198 miles of 22-in. between Payette and the Columbia River at the Oregon-Washington border.

A. J. Curtis Construction Co., Casper, section 26, 54 miles of 16-in. laterals and 31 miles of gathering-system lines from a point on the main line near Kemmerer, Wyo., to Big Piney field, Wyoming.

R. H. Fulton, Lubbock, section 27, 43 miles of lateral lines and 16 miles of gath-

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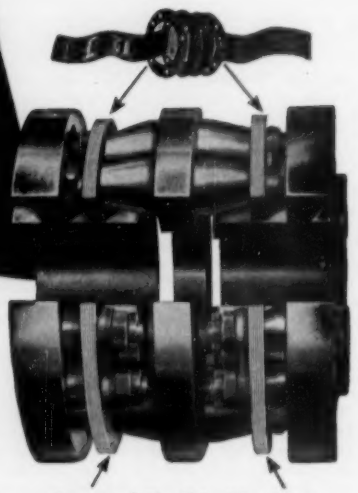

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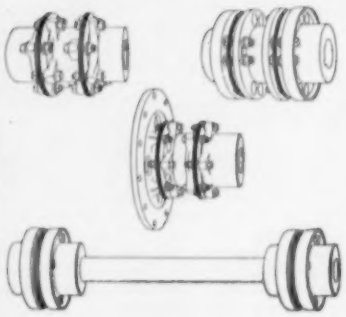
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



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Pipeline Patrol

ering lines from Rangely, Colo., to Piceance Creek field, Colorado.

H. B. Zachry Co., San Antonio, has contract for 42 miles of 4 to 16-in. line in the San Juan basin area of New Mexico. Pipe laying began in January.

• **Pine Tree Natural Gas Co.**—204 miles of undetermined size pipe to run from the Boston area to Bangor, Me.

Pioneer Natural Gas Co.—R. H. Fulton & Co., Lubbock, Tex., has started construction on 56 miles of line for this company near Lamesa, Tex. Twenty-eight miles of 22-in. and 28 miles of 10-in. make up the job.

Portland Gas & Coke Co.—United Engineers & Constructors, Inc., of Philadelphia, has engineering contract for 80 miles of various size lines up to 16-in. for this Portland, Ore., firm. River Construction Corp. is winding up work on a 16-in. river crossing of the Williamette River for the company.

Private Interests.—Proposes to build gas line from Gubik gas field near Navy Petroleum Reserve No. 4 in Alaska to Fairbanks. Line would be 450-mile, 8-in. line and Arctic Contractor, Inc., who handled engineering requirements and preliminary design, estimated the line would cost $20,000,000 although later figures have been much higher than this.

• **Southern California Gas Co. and Southern Counties Gas Co. of California.**—Firms have plans for three separate jobs. First is 19 miles of 30-in. from Placentia to Compton, Calif. Completion set for November 1956. Second job is 70 miles of 30-in. from Palmdale to Alhambra, Calif., and completion is slated for November, too. Third job is 210 miles of 30-in. from Topock to Palmdale. Last job not expected to be finished before April 1957.

• **Southern Natural Gas Co.**—Company has temporary FPC authority to build 39 miles of loop lines and add 4,950 hp. to its compressor power near Atlanta, Ga. Job will cost about $2,000,000.

Tennessee Gas Transmission Co.—The firm has the following projects under way or planned.

Project 1—370 miles of 30-in. line from Agua Dulce, Tex., to Kinder, La. Contractors are Morrison Constructors, Inc.; Williams Bros.; Houston Contracting Co.; H. C. Price Co.; Western Constructors; N. A. Saigh Co.; Panama-Williams Co.; and Associated Pipe Line Constructors, Inc. Completed.

Project 2—250 miles of 24-in. from Coudersport, Pa., to Greenwich, Conn. Contractors are H. C. Price, Bechtel Corp., and Pentzien, Inc. Completed.

Project 3—147 miles of 26-in. and 74 miles of 30-in. Thirty runs from Cave City, Ky., to Danville, Ky. Twenty-six-inch runs from a point north of the Ohio River to McConnellsville, Ohio, and from Newcomerstown, to near Lisbon, Ohio. Approved by FPC but not yet contracted. Completion set for fall of 1956.

Project 4—192 miles of 24-in., 34 miles of 20-in., 15 miles of 18-in., and approximately 110 miles of 4, 6, 8, 10, and 12-in. from point west of Crowley, La., looping the Bayou Sale gathering line for a distance of 74 miles to a point near the mouth of the Mississippi River. Job not yet contracted. Completion set for summer of 1956.

Project 5—63 miles of 30-in. and 99 miles of 26-in. Thirty-inch will run from Scottsville, Ky., to Cave City, Ky., and from point southwest of Danville, Ky., to a point northeast of Danville. Twenty-six-inch will run from near Greenup, Ky., to just north of the Ohio River; from McConnellsville to near Newcomerstown and from Lisbon to Mercer, Pa. Application pending with FPC.

Project 6—Approximately 100 miles of 4, 6, 8, 10, and 12-in. gathering lines in the Gulf Coast area of Texas and Louisiana. Application pending with FPC.

(For news of a Tennessee subsidiary see Midwestern Gas Transmission Co.)

Texas Eastern Transmission Co.—Company has received FPC permission to begin converting its Little Inch line from natural gas to products service. Company has also proposed to Mobilization Director Arthur S. Flemming that the Government give it accelerated amortization on money to invest to put the Big Inch line on standby product service. The company's program is:

...To convert the Little Inch to products with a capacity of 235,000 bbl. daily and to install enough standby pumping equipment to hike the capacity to 375,000 bbl. daily if needed.

...To install standby pumping equipment along the Big Inch that would allow the line to be converted from gas to products in an emergency. The line would have a capacity of 425,000 bbl. daily.

Company asked the FPC late in December 1955 for permission to build a 422-mile, 30-in. line from McAllen to Beaumont, Tex. The line would be used to transport imported Mexican gas. The firm also asked the FPC for permission to loop 530 miles of its 30-in. line from Kosciusko, Miss., to Uniontown, Pa. The company will also lay 45 miles of 24-in. from Provident City, Tex., to connect in Matagorda County, Texas. This would tie the Wilcox Trend Gathering System in with the extension from Mexico. The company will add 50,000 hp. in new compressor capacity and enlarge existing stations by 20,780 hp.

Company also has 110 miles of 3, 4, 6, 8,

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Pipeline Patrol

10, and 12-in. pipe being laid in Texas, Louisiana, Arkansas, Pennsylvania, and Mississippi. Work will be completed in early 1956.

• **Texas Gas Transmission Corp.**—Company has received authority from a FPC examiner to build a 105-mile supply line extending from East Lake Palourde Gas field in Assumption Parish, Louisiana, to its system in Arkansas, Mississippi, Tennessee, Kentucky, and Indiana. The lines and additional compressor facilities totaling 19,190 hp. will cost about $20,000,000.

• **Transcontinental Gas Pipe Line Corp.**—Company has announced plans for a $35-$50-million expansion this year. Exact plans haven't been announced yet.

• **Transcontinental Gas Pipe Line Corp.**—Company received FPC permission on November 29 to construct 24 miles of line to gather gas from South Bayou Mallet, Maxie, and Happytown fields of Louisiana. The project will cost approximately $754,000.

• **Trunkline Gas Co.**—Firm has applied to FPC for authority to build eight new compressor stations and 24 miles of pipeline on its transmission system to enable it to sell additional gas to Panhandle Eastern Pipe Line Co. Total capacity of the new stations would be 56,000 hp. Total cost would be $18,700,000, including $1,000,000 for gathering facilities in the Gulf Coast area. Panhandle filed for 1,600 hp. additional compressor capacity to cost $3,714,000.

• **Utah Natural Gas Co.**—Planning 40 miles from Orem to Salt Lake City, 16-in. pipe at later date. Contract not yet let.

• **United Gas Pipe Line Co.**—Firm has received Federal Power Commission authority to construct 105 miles of pipeline in Mississippi, Alabama, Georgia, and Florida. The company will also add 5,300 hp. in compressor capacity. The job will cost about $12,500,000.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.—Firm is building a 150-mile, 21-in. line from Safaniya field to near the Neutral Zone border.

• **Cremona Pipe Line Co.**—Firm has announced plans for a 60-mile crude-oil line from the Westward Ho-Sundre area to Calgary.

• **Esso, A. G.**—West Germany affilate of Standard Oil Co. (N. J.) plans line from North Sea port to Rhur-Rhine area. This will probably be 120-mile, 10-in. from Rotterdam to Cologne, the latter rumored as the site of a new 58,000-bbl. refinery to be built by the company.

Ganso Azul Cia de Petroleo.—Company is building a 47-mile, 4-in. line from Agua Caliente field to Pucallpa, a port on the Ucayali River.

• **Gulf Italia Co.**—Firm will build a 35-mile line from its Ragusa field in southwestern Sicily to a refinery at Augusta operated by RASIOM, an Italian company. The line size was not disclosed. Work is expected to be completed by the end of summer.

Interprovincial Pipe Line Co.—Majestic Contractors, Ltd., has contract for 67 miles of 24-in. and 2 miles of 26-in. along the company's system from Alberta to Sarnia, Ont. The Majestic work will be between Carroll and Somerset, Man., and 2 miles between the U. S. border and the Gretna pumping station. Work will be completed near the end of summer 1956.

Westspur Pipe Line Co.—Firm has awarded contract to Majestic Contractors, Ltd., Edmonton, for 109 miles of 12-in. line from Midvale, Saskatchewan, to Interprovincial Pipe Line Co.'s pump station at Cromer, Manitoba. West spur has also let contract to same company for 50 miles of various size gathering lines in the Midale-Frobisher area of Saskatchewan.

Foreign Products Pipelines

• **North Atlantic Treaty Organization (NATO).**—This defense organization is building products lines to airforce bases in various parts of France. Approximately 2,000 miles of 4-in. line will be laid.

NATO—Associated Pipeline Contractors, Inc., Houston, is laying 450 miles of products line from Iskenderun, Turkey, to Batman, also in Turkey.

Overland Pipeline Corp.—This South African firm has requested government permission to build a 350-mile line, to cost $8,450,000 from the South African coast to Rand, a plateau area in southern Transvaal where there is heavy petroleum consumption.

The United States Defense Department.—Department is sponsoring a 485-mile, 8, 10, 12-in. products line from Cadiz to Zaragoza, Spain. The contract has been let to Merritt Chapman & Scott; Benson & Montin of Oklahoma City; and Agroman Construction Co., a Spaniish firm. Brown-Raymond-Walsh is the prime contractor. Cost of the line will be approximately $5,000,000.

Winnipeg & Central Gas Co.—Canadian company plans to build a $20 million butane propane system. Company plans to get gas L.P.G. from Signal Oil & Gas Co.'s Tioga N. D., plant and move it to Winnipeg. Size and route of the line has not been definitely established.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co.**—Company will spend $47,000,000 to build 547 miles of gas-gathering system for the Trans-Canada line. The 1956 stage of construction will total 219 miles and cost $22,650,000. The first part would start near Saskatchewan and include Pincher Junction, Provost, Bindloss, Sibbald,

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Pipeline Patrol

Oyen, Sunnynook, Steveville, and Cessford. The second part to be built in 1957 will consist of 328 miles and cost $24,400,000. The second phase will include Countess, Duchess, Princess, Homglen-Rimbey, and Nevis.

Attock Oil Co.—Company plans to build 60-mile natural gas pipeline from Dhulian field to Rawalpindi in West Pakaistan.

Cia. Shell de Venezuela.—Company has announced plans for a $21,000,000, 177-mile, 20-in. natural-gas line from La Paz field in the Maracaibo district to the Cardon refinery on Paraguana Peninsula. The gas will be used as the chief fuel in the refiner's furnaces. The line is expected to go into operation in 1957.

• **Empresa Nacional del Petroleo.** — 80 miles, 10-in., planned, Concon to Santiago Chile.

• **Gas Industrial de Monterrey.**—Company has announced plans for a 22-in., 130-mile natural-gas line from Reynosa to Monterrey in northern Mexico. The project will parallel a 14-in. line which has been supplying Monterrey since 1947.

Imperial Oil, Ltd.—This Canadian firm has let contract for 65 miles of 4 to 16-in. gas-gathering system in the Redwater area of Alberta.

• **Magna Pipeline Co.**—Firm has plans to build a $6,000,000 underwater line from Anacortes or Bellingham in Washington to Victoria. The line is expected to be completed by the fall of this year.

North Canadian Oils, Ltd.—Dutton-Williams Brothers, Ltd., of Edmonton, has contract for 136 miles of 10-in. line from Wabumun to Hinton, Alta. Mid-Western Industrial Gas, Ltd., which will supply gas along with North Canadian to a pulp mill at Hinton, will build a line from its gas fields in the Alexander, Majeka Lake, and Westlock districts to Wabumun.

South Alberta Pipe Line, Ltd.—Company has filed permit to construct a 150-mile, 8-in natural-gas line from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta. The line will cost about $1,000,000.

• **Sui Gas Transmission Co.** — Pakistan Constructors, a joint company of Morrison Knudsen, Boise, Idaho, and William Press Ltd., London, have contract to build a 188 mile, 16-in. line from Sui gas field to Moultan, Pakistan. Work will begin in mid-1956 The line will later be extended to Lahore with branches at Kot Addu, Jhang, Magiana and Montgomery.

• **Trans-Canada Pipe Lines, Ltd.**—Firm has about completed financing arrangements for a 2,250-mile natural-gas line from Alberta to Toronto and Montreal. The Ontario government has agreed to help finance the line through its province. Tennessee Gas Transmission Co. has proposed a line to take gas from the company at Emerson, Man. (See Midwestern Gas Transportation Co.)

Union of Soviet Socialist Republic.—Russian Government has completed about ,200 miles of a 900-mile natural-gas line from Stavropol in the Northern Caucasus to Moscow. The completed section links Stavropol with Rostov. The line is being built of 26-in. pipe and is much larger than the other two major gas lines in Russia which are 16 and 18-in. When completed the line will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Westcoast Transmission Co., Ltd.—Company is starting work on a 650-naile, 30-in line from the Peace River area in Canada to Sumas, Wash. Contractors are Mannix, Ltd., Canadian Bechtel, Ltd., R. A. Conyes Construction Co., and Dutton-Williams Brothers Co., Ltd. Cost to be about $120,000,000

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Signal Drills 16,500-ft. Test with 6,500-10,000-ft. Rig

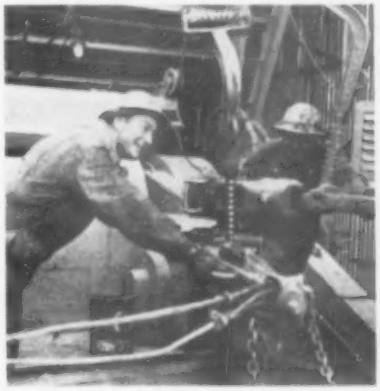
Signal Drilling Co., Tulsa and Casper, recently completed drilling a 16,531-ft. wildcat test with a rig normally rated for a depth range of from 6,500 to 10,000 ft.

The test is on Phillips Petroleum Co.'s Sublette unit near Daniels Junction, southwest of Pinedale, in Sublette County, western Wyoming.

Since completion of the hole, a string of 5½-in. casing has been cemented at 16,524 ft., and testing of various deep zones in which oil and gas showings were logged is under way. Initial tests are in a formation perforated at 16,340-70 ft. and 16,475-16,505 ft.

Signal used a National Type 8-B rig, powered by three Buda Model 2505 super-charged engines, and including an Emsco Model D-500 pump for main mud circulation.

The well was spudded December 25, 1954, as a 12,500-ft. Mesaverde test. Below 13⅜-in. surface casing cemented at 499 ft., 9-in. hole was carried to 16,200 ft., using 4½-in. drill pipe with 14 6¼-in. (o.d.) drill collars to 13,700 ft., and 3½-in. drill pipe with 10 drill collars for the remainder. Hole below 16,200 ft. to total depth was made with 8¾-in. bits.



On the floor of Signal's deep-drilling Wyoming rig.

Johnson Drilling & Service Co., Magnolia, Ark., is drilling another Pettet test for Klein & Caruthers, of Shreveport, to confirm these operators' recent discovery in West Lisbon field, Claiborne Parish, North Louisiana. The new operation, 1-B King, in 29-21n-5w, is about ½ mile south of the discovery well, which found the pay at 5,325 ft. It is projected to 5,400 ft.

Miller & York, Bakersfield, Calif., have a rig on a well-deepening job for Trigood Oil Co., of Casper, Wyo. The well, in the Greenacres area, 4 miles west of Bakersfield, was drilled last year by Sunset Oil Co. to 4,705 ft., where it was quit after unsuccessful efforts to complete in the Chanac sand. Hole will be carried by the present operator to about 7,000 ft.

Sunnyland Contracting Co., Rayne, La., is contractor on a new Wilcox test 4 miles northwest of Harrisonburg, in northern Catahoula Parish, eastern Louisiana. It is being drilled for Calto Oil Co. and others. Scheduled depth is 5,000 ft.

Kern-Trimble Drilling Co., Magnolia, Ark., has contracted for an 8,500 ft. test to be drilled for McCalman Drilling Co., Inc., of Homer, La., at a wildcat location 5¼ miles southeast of Bernice field, in Union Parish, North Louisiana. The test is listed as 1 Long, with location in 26-21n-2w. The Bodcaw sand (Cotton Valley) is the objective.

Hagestad Drilling Co., Bakersfield, Calif., is drilling on its second well for Richard S. Rheem in the new Race Tract Hill area, in Kern County, southern California. Location at Superior-Claflin 16-26, in 26-29-29, is about ½ mile northeast of the operator's newly completed discovery well, productive from a 4,650-ft. sand.

Martin Connection Works, Laurel, Miss., has a new contract operation in the Melvin area, northwest of Gilbertown field, in Choctaw County, western Alabama, near the Mississippi line. It is a 4,000-ft. Eutaw test for Dave Gammill, of Jackson, Miss., and C. F. Martin, of the contracting company. Location, at 1 Robert Land, in 26-11n-5w, is southeast of production.

Clark Drilling Co. is working at a remote location in the Curlew Valley area in northern Box Elder County, northern Utah. Location is nearly 50

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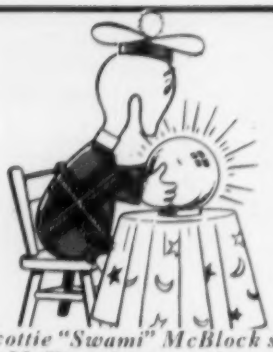

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miles northwest of Brigham, and just south across the line from Idaho's Oneida County. It is 33 miles southwest of Malad, in the latter county. Drilling is for Utah Southern Gas Co. at 2 Federal, in 6-14n-9w.

Big Chief Drilling Co., Oklahoma City, is under contract to Stanolind Oil & Gas Co. for a 10,700-ft. Smackover test in Mount Sinai field, Claiborne Parish, North Louisiana. Location is for 1 Meadors Unit, in 5-22n-5w.

Lowe Drilling Co., Midland, Tex., has taken on another deep-drilling job for Continental Oil Co. in the Bell Lake area, southern County, New Mexico. The new operation, scheduled to go to 17,000 ft., is at a wildcat location south of Continental's deep Devonian production. The test will be at 4 Bell Lake Unit, in 6-24-34.

Carmack Drilling Co., Denver, has new operation going near Woodrow, in western Washington County, northeastern Colorado. It is a joint-account test for itself and Al Ward & Son. Location at 2 Bell, in 12-1s-56w, is about 2½ miles east of production in the Bobcat area.

Moore Drilling Co., Calgary, Alta., has a rig working for Souris Valley Oil Co., Ltd., in the Northeast Daly field, west of Virden, in Manitoba Province, western Canada. Current operation, the company's first on its recently acquired 320-acre lease, shared by Pascar Oils, Ltd., is at 3-24 Wardle, in LSD 3, 24-10-28 W.P.M.

Nuckolls - Bell Drilling Co., Oklahoma City, is drilling for Clark & Cowden at a wildcat location north of the Shawnee area, in Pottawatomie County, Central Oklahoma. It is a projected 5,600-ft. Wilcox test at 1 Farm, in 22-11n-4e.

Aylward Drilling Co., Wichita, Kans., is on a new wildcat operation in Kiowa County, southwestern Kansas. It is a contract job for Bachus Oil Co. at 1 Wykle, in 33-29-19. Location is 9 miles southeast of Mullinville, and about 3 miles southwest of Nichols field. Contract is for a 4,900-ft. Mississippian test.

Welch & Olsson Drilling Co. is contractor on a new 4,500-ft. Mississippian test Rooney, Siegfried & Thomas are putting down 3 miles west of Arnold, in northwestern Ness County, western Kansas. Location, at 1 Michaelis, in 20-16-25, is 2½ miles from production in Arnold field.

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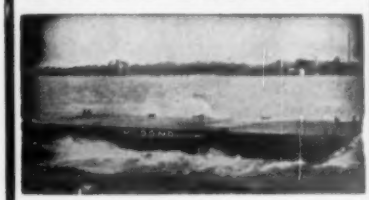

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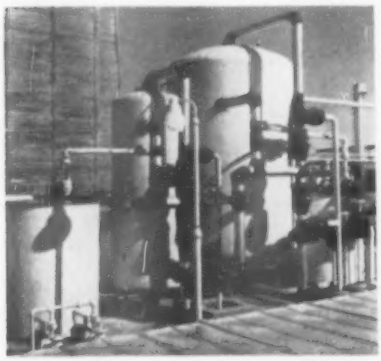
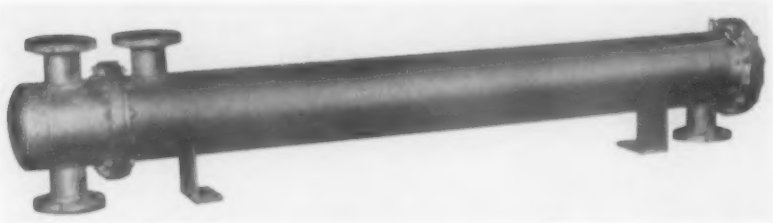


The CCD unit is regenerated with salt in exactly the same manner as the zeolite softener. No acid is required in any portion of the process. Frequently, the CCD process is combined with a zeolite softener to obtain water of zero hardness and low alkalinity.

CCD, by sharply reducing the carbonate alkalinity of the boiler makeup water, will proportionately reduce the amount of carbon dioxide released to the steam, resulting in reduced corrosion rate in the steam condensate return system. Again, by adding a zeolite softener unit, water quality will be even better since all hardness will also be removed.

The CCD zeolite softener installations are small, compact, and are generally furnished completely automatic, requiring almost no attention by plant operating personnel. **For more information write or call: Continental Products Corp., 501 Phillips Building, Odessa, Tex.**



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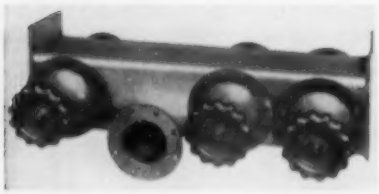

Truck Manifold Valves Now Made of Aluminum

New, light-weight, aluminum fabrications of manifold valves has been announced for petroleum tank-truck service. The new units, available in 2, 3, and 4-in. sizes, are designed especially for use on aluminum tanks but are suitable also for service on steel tanks when absolute minimum weight is required.

These aluminum manifolds have the same fast unloading and safety features of other Warren fabrications of regular steel for petroleum service and of stainless steel for chemical products. All three metal constructions are made in square, dual, split, and selective models with any number of valves, any location and angle for connections, and any type of outlet. There are no gaskets between valves to leak or replace. Joints and connections are reduced to a minimum. **For more information write or call: Betts Machine Co., 1800 Pennsylvania Avenue West, Warren, Pa.**

●

Air Tool Combines Impact Nut-Running, Torque Control

A new air-operated torque-control Impactool will run a nut to any desired torque, then automatically shut itself off. The tool incorporates the first application of the torsion-bar principle to torque control. The action of the mechanism can be likened to that of a pogo stick, which bounces evenly on soft ground, but suddenly rebounds higher when it strikes a hard surface.

While the nut is being run to required torque, the Impactool operates at normal power and speed, but when required torque is reached and nut-running resistance is equal to the stress preset in the torsion bar, the impact mechanism rebounds instantly and trips a rubber-faced shutoff valve.

Torque setting is simple. It can be easily and quickly set by using a jig which turns a torsion bar and calibration collar to the desired reading against rigid splines on the torque bar adjusting sleeve. Torque setting remains constant for any nut-running operation until the adjustment is changed. Releasing the trigger resets the tool automatically to the same torque for the next nut. The operation is reversible with full power in either direction.

Since the torsion-bar torque control does not depend on the operator's sense of timing, the tool can be used accurately by inexperienced operators without any special training. All that's necessary is to set the tool and pull the trigger. **For more information write or call: Ingersoll-Rand Co., Air Tool Division, 11 Broadway, New York 4, N. Y.**

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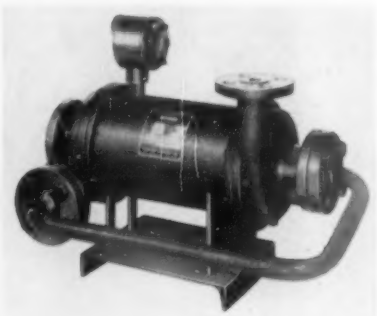


Double-Ended Canned Pump Made for Corrosive Service

New 3-hp. Series DE (double-ended) Chempump is the latest addition to the company's line of canned motor pumps for leakproof handling of corrosive, toxic, or explosive liquids.

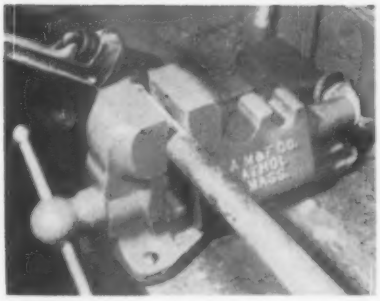
Basically a two-stage pump, the pumping chambers can be piped in series (shown) or parallel for remarkably compact high-head or high-volume pumping. Over-all size of the pump is less than 2 by 1 by 1½ ft., yet the new Series DE gives heads to 230 ft.

The new pump, already in extensive service, is available in cast iron, cast steel, 300-series stainless steel, Monel and Carpenter-20. Standard temperature and pressure limits are 450° F. and 300 psi., respectively. **For more information write or call: Chempump Corp., Station J, 1300 East Mermaid Lane, Philadelphia 18, Pa.**

●

Heavy-Duty Vise Has 5-In. Long Pipe Gripping Surface

This heavy-duty vise, weighing 150 lb., is of semisteel construction, which has the rugged strength necessary to take punishment and hammering. This vise has a gripping surface of 5 in.



by 4 in. on the face of each jaw with a total depth of approximately 6 in. Machined into the heat-treated tool steel jaw facing, is a full 5-in.-long grip, which will take a pipe or rod from ⅛ to 6 in. in diameter and give a full 5-in.-long grip on both sides of the pipe or rod to give maximum holding power for freeing fittings or nuts.

The tops of the jaws are massive and have an area long enough to be used in many cases for riveting or as an anvil surface when necessary. Because of the ruggedness of this vise, it is an excellent one for the bending of heavy iron bars. **For more information write or call: Athol Machine & Foundry Co., Athol, Mass.**

•

Tight-Closing Valve Made For Complete Shut-Off Use

Filling a need for a tight-closing valve with good modulating characteristics, the new Type MA valve is particularly applicable on medium and high-pressure pipelines for difficult dead-end or complete shut-off service.

The MA valve was specially designed to avoid sticking and clogging. At the same time, the valve does not develop a tendency to chatter or rattle. In tests on pipelines with pressures up to 250 psi., the MA has functioned quietly.

Available in sizes from ¾ to 2 in. inclusive, the valve body is cast bronze. Poppet, seat insert, pilot poppet, and pilot seat are fabricated from stainless steel, and the valve stem is of Monel. Sizes ¾ to 1½ in. have union ends; 2-in. size has flanged ends.

The MA valve, which is piston balanced, contains a poppet that is directly operated by the valve stem, and hence is considered full modulating. Maintenance of the new valve is simplified by readily available factory-finished replacement assemblies consisting of valve stem and pilot poppet, main poppet and pilot cage, and seat insert and piston. **For more information write or call: Fulton Sylphon Division, Robertshaw-Fulton Controls Co., Box 400, Knoxville, Tenn.**

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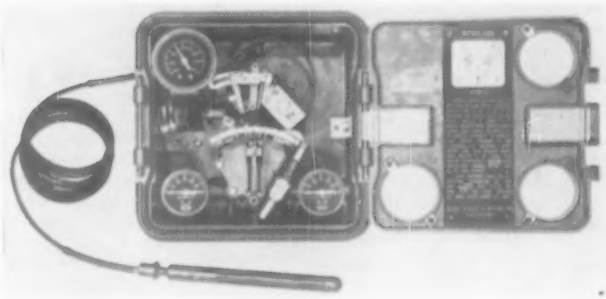

New Controller Offers Range Choice

The new Type 1460 temperature controller is for positive fluid flow control through diaphragm-operated valves, based on temperature variations.

Equipped with an external vapor-tension thermal system to actuate the power unit in the pilot, the 1460 offers a choice of temperature ranges. By simple adjustment, it permits either 100 per cent throttling action or on-off snap action within a wide limiting range.

The 1460 has all the excellent features offered in the 1440 and 1450 pilots, being identical except for the actuating mechanism. Two pressure gages and a temperature indicator are compactly built into the pilot case. **For more information write or call: Black, Sivalls & Bryson, Inc., 7500 E. Twelfth Street, Kansas City 26, Mo.**

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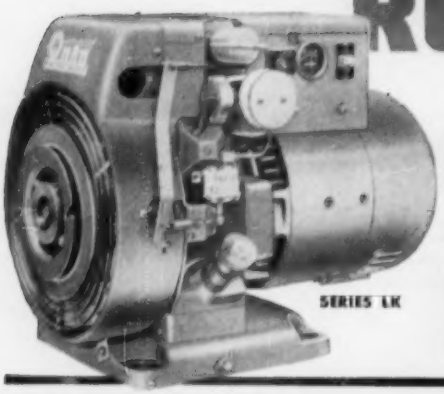

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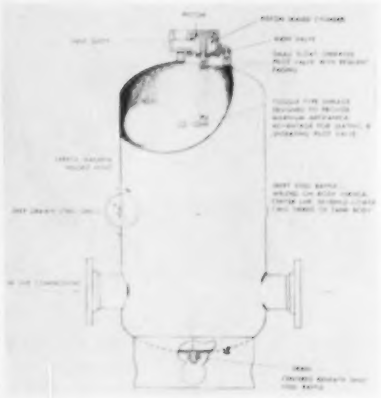

New Air Eliminators Offer Straight-Through Flow

Completely redesigned models of a line of air eliminators for use with liquid meters offer new straight-through flow, greater ruggedness, and increased versatility.

Chief advantages of the new air eliminators include easy access to all working parts and in-line outlet and inlet connections. Access to working parts is achieved by removing four bolts in the valve body flange and lifting out the air-release valve assembly. In-line connections eliminate the need for elbows. Other advantages include replaceable faces and seats, resilient facing protecting the main and pilot-valve assemblies and toggle-type float arm to the pilot-valve linkage.

The new eliminators are available with steel bodies in 2-in. screw models and 3, 4, and 6-in. flanged models, or with corrosion-resistant 316 stainless-steel bodies in 2 and 3-in. sizes. **For more information write or call: Meter & Valve Division, Rockwell Manufacturing Co., 400 North Lexington Avenue, Pittsburgh 8, Pa.**

•

Ignition System Designed For Heavy-Duty Service

A new ignition system for heavy-duty high compression gas engines used in the petroleum and power-plant fields combines a new type Bendix LC magneto with the Hi-V transformer coil. This combination was engineered to meet the exacting requirements of large stationary industrial engines of 6 to 16 cylinders ranging from 1,000 to more than 4,000 hp.

This new system is precisely balanced and delivers more than ample voltage with minimum spark-plug erosion. Its features include long service life, reduced maintenance costs, and flameproof design.

Adjustments of the master breaker of the LC magneto is normally required only once a year, during major engine-overhaul periods. In addition, the LC magneto has a high output at normal cranking speeds and does not require an impulse coupling for starting.

The unit-breaker assembly is easily adjusted and operates with minimum wear, due to low current at the breaker points. Advancing or retarding the spark is accomplished by rotating the entire magneto section, either manually or through a mechanical linkage, and this allows the voltage to remain constant.

All shafts of the magneto are mounted on sealed ball bearings; its cam material and cam-follower material are matched for minimum wear; mechanical and electrical components are designed to withstand severe vibration; and a special design provides dustproof ventilation. Windows in the distributor housing cover and the gear box also permits easy accessibility for servicing. **For more information write or call: Scintilla Division, Bendix Aviation Corp., Sidney, N. Y.**

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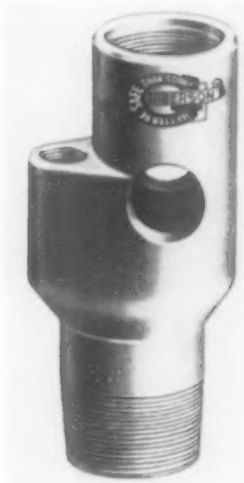

Down-Hole Separator Eliminates Gas Locks

This down-hole separator eliminates the problem of gas locks in pumping wells where the produced fluid has a high gas-oil ratio. Less than 1 ft. in length, the separator is screwed directly into a packer and the pump shoe fitted directly on the separator.

One to four joints of bypass pipe, depending upon the producing characteristics of the well, are screwed into the separator and clamped to the tubing. Attached to the top of the bypass pipe is a half-coupling cut on a diagonal which guides the unit past casing joints.

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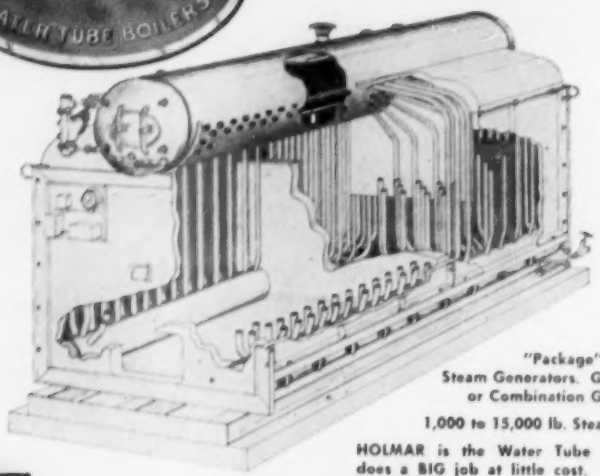

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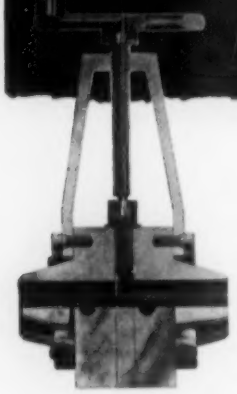

FIGURE 1000 ORIFICE FITTINGS give you the speed of a gate valve in changing orifice plates: You simply back out the carrier, push the old plate out with your fingers, insert the new one, and run the carrier down. Oil-resistant O-Rings assure positive pressure seals; mechanical stops always position the carrier in the exact center of the line. Pressure taps are positioned in accordance with accepted specifications, and the fitting may be used in either direction. Sizes, 2", 3" and 4", for 2000 psi working pressure, welding, threaded or flanged connections. Uses standard orifice plates.

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Bypass pipe hugs the tubing as snugly as couplings permit.

Production crosses over from the tubing below the packer into the annulus above it and is carried well above the pump shoe by the bypass pipe. The large annulus above the packer allows the gas to break out of solution, and the oil drops back to the large reservoir above the packer where it is picked up by the pump, comparatively free of gas.

Separated gas is bled off of the casing continuously. Intake ports on the separator have a larger bypass area than the tubing. The separator is available for 2-in. EUE 8 round-thread field connections with ¾-in. bypass or 1-in. bypass and for 2½-in. EUE 8 round-thread field connections with 1-in. bypass. **For more information write or call: Guiberson Corp., P. O. Box 1106, Dallas, Tex.**

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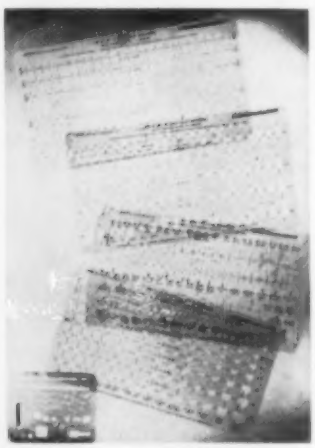

Templates Make Plant Layout Drawing Easy

A new matched set of five reversible templates for drawing general layouts or details of any valving and piping system in a fraction of the usual time contains all American Standard symbols and has provisions for new or special symbols.

At least 5,000 commonly used pipe, fitting, and valve diagrams can be pencil drawn with great accuracy by using the cutout symbols on the templates singly or in combinations. Layouts made with them can be used for any fluid or gaseous processes such as pipelining, refining, or pumping.

A complete kit of four 5⅜ by 9⅞-in. pipe, pipe fitting and valve indication templates, and one dimensioning template, is available or the larger four templates may be ordered individually. **For more information write or call: A. Lawrence Karp, 16 Putnam Park, Greenwich, Conn.**

OIL AND GAS JOURNAL

Showcase

- BULLETINS
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Welding Fittings and Flanges. This six-page folder, identified as FB-500, furnishes in concise form the types and size ranges of various welding fittings and flanges which can be furnished by the division. **For more information write or call: Tubular Products Division, Babcock & Wilcox Co., 161 East Forty-second Street, New York, N. Y.**

•

Liquidometer Capacitor-Type Fuel Gages. A new booklet, Bulletin 546, covering Liquidometer capacitor-type fuel-gaging systems, describes true weight-gaging systems, compensated and uncompensated capacitor-type fuel gages, repeater indicators, fuel-gage totalizing systems, selective indicators and thermistor applications for fuel-level warning and control. **For more information write or call: Liquidometer Corp., Department S, Skillman Avenue & Thirty-sixth Street, Long Island City 1, N. Y.**

•

Fawick VC Ventorque Clutch contains a complete description of all sizes of VC clutch elements and applications, including complete dimension and capacity data in easy-to-read table form. Ventilated construction, a distinctive feature of the VC Ventorque clutch, is discussed. Listings are made showing uses of this clutch in the drilling and construction industries. **For more information write or call: Clement Reeves, Fawick Airflex Division, Fawick Corp., 9919 Clinton Road, Cleveland 11, Ohio.**

•

International Trail. Lane-Wells Co. of Los Angeles, which provides technical service and products to the oil industry, is the subject of a feature story in the current issue of International Trail magazine, a nationally distributed publication of International Harvester Co. Action pictures of the firm's well-logging operation help to describe the firm's activities in 14 oil-producing states. **For more information write or call: International Harvester Co., 180 North Michigan Avenue, Chicago 1, Ill.**

Roskote Cold Applied Pipe Mastics. A new, completely revised, four-page folder includes complete application instructions, a detailed description of Roskote's properties, and full test data. The test data give specific figures and graphic representations of volume resistivity during and after drying. **For more information write or call: Royston Laboratories, Inc., Blawnox, Pittsburgh 38, Pa.**

•

Heat-Transfer Equipment. A two-page, pictorial bulletin shows typical custom-designed tube heat exchangers and similar equipment, as well as plant facilities for repair and servicing of such equipment. **For more information write or call: Texas Metal Fabricating Co., P. O. Box 7567, Houston 7, Tex.**

•

Wire Lines for Drillers, a comprehensive 60-page handbook on the selection, use, and care of wire rope in drilling operations, covers wire-rope applications in oil, gas, and water-well drilling operations. Sections are devoted to: using and maintaining J & L wire rope; wire ropes for rotary drilling; wire ropes for cable-tool drilling; wire lines

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for production; and tables of strength of oil-country wire lines. The handbook is pocket sized for ready reference. It has numerous drawings comparing the right and wrong ways of using and maintaining wire rope. Also included are, diagrammatic drawings of the various types of wire rope. **For more information write or call: Wire Rope Products Division, Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa.**

●

Extreme Service Lubricants and Greases. A new two-color catalog describes in detail the specifications and uses of multipurpose greases, outside gear and track-roller lubricants, MX gear oils with Moly-Disulphide, chain and gear oil, Kopr-Kote antiseize compound, thick-or-thin sealing compound and Moly-Spray air-dry lubricant. This catalog will be a helpful guide in solving lubrication problems. **For more information write or call: Jet-Lube, Inc., 3093 North California Street, Burbank, Calif.**

●

Bridge Plugs. Latest techniques and operating features of a new one-piece, drillable, all-metal, explosive-expansion bridge plug are described in a four-page technical Bulletin 102 just released. The illustrated bulletin tells in detail the utility of the bridge plugs, which come in 37 sizes, and which are used to plug in tubing, drill pipe, casing, and in open hole in hard formations. **For more information write or call: McCullough Tool Co., 5820 South Alameda Street, Los Angeles, Calif.**

●

Silicone Rubber Products. A new eight-page Bulletin AD 147 describes the complete line of Silicone Rubber products, said to withstand high or low temperatures; resist sunlight, ozone, and aging; possess excellent dielectric properties; and resist low-swell mineral oils at high temperatures, as well as possessing good resistance to a large variety of other chemicals. Applications include molded and extruded parts for industrial seals. **For more information write or call: Garlock Packing Co., Palmyra, N. Y.**

●

Solution to Your Problem of Scale and Corrosion Control. The revised edition of a 16-page catalog describes 11 glucosates that prevent scale and corrosion. Each has a different use for its specific application. Those glucosates can be obtained in package form ready to use. They include control of scale and corrosion in cooling-water, boiler-feed, humidifiers, and brines systems. **For more information write or call: D. W. Haering & Co., Inc., P. O. Box 6037, San Antonio, Tex.**

●

Baker Retainer Production Packer. Catalog Supplement 502 contains sections covering the features and advantages of the DA and DB retainer production packers; accessories; setting tools, specifications, and ordering instructions; operating instructions and procedures; and applications in various types of single-zone and dual-zone completions. **For more information write or call: Baker Oil Tools Inc., P. O. Box 2274, Terminal Annex, Los Angeles 54, Calif.**

●

Deflection Indicator. Magnetic-amplifier-type deflection indicator, applicable to any equipment in which early detection of relative movement is desirable, is described in a new eight-page bulletin O5B8385. The indicator is designed to safeguard hydrostations, compressor and pumping stations, drive shafts, and other applications. A 60-cycle, 110-volt power source and a suitable location for mounting two compact inductor-coil pickup units are its

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only requirements. The indicator offers potentials for both remote and local operation. In either instance, visual or audible alarm systems can be activated to call attention to deflection or motion. **For more information write or call: Allis-Chalmers Manufacturing Co., 1959 South Seventieth Street, Milwaukee, Wis.**

●

Activated Carbon G-32, a six-page fold-out explains the characteristics and properties of this activated carbon, particularly as it relates to processing involving solvent recovery, air and gas purification, catalyst carrier, adsorption fractionation, selective adsorption, and chromatographic separation. Typical flow diagrams illustrate the text. **For more information write or call: Catalyst Department, The Girdler Co., Louisville 1, Ky.**

●

Weathercoat for Insulation Protection. A new eight-page, two-color, illustrated bulletin describes uses for Laykold Weathercoat, a cold-applied asphaltic composition, in providing a durable protective coating on all types of thermal insulation in refineries and field-processing plants. The product is described as being compounded from selected asphalts, with a high resistance to moisture in all its forms, both liquid and vapor. **For more information write or call: American Bitumuls & Asphalt Co., 200 Bush Street, San Francisco, Calif.**

●

Alloys for Heat-Exchanger Problems. This 28-page, illustrated bulletin presents typical installations of cupronickel or nickel-copper alloys in power plants. These alloys give longer life, dependable service under ordinary conditions and when plagued by pollution, brackish water, or excessive turbulence. Corrosion-resistant cupro-nickel is shown serving satisfactorily for many evaporators, condensers, and feed water heaters. **For more information write or call: Reader Service Section, International Nickel Co., Inc., 67 Wall Street, New York 5, N. Y.**

●

Special Steels for Industry. This 16-page booklet gives details as to stainless steels, electrical materials, Carmet carbide materials, and tool steels manufactured by the organization. Numerous charts giving analysis of various steels, as well as detailed information on fabrication and properties, are included in the booklet. **For more information write or call: Allegheny Ludlum Steel Corp., 2020 Oliver Building, Pittsburgh 22, Pa.**

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EQUIPMENT MEN . . . in the News

Schlumberger Promotes Forsythe and Miller

C. R. MILLER

R. L. FORSYTHE

Promotions for Russell L. Forsythe and Charles R. Miller have been announced by Schlumberger Well Surveying Corp. Forsythe has been promoted to assistant manager of the Pacific Coast area with headquarters in Los Angeles. Miller replaces Forsythe as manager of the Kansas division. Schlumberger also announced the opening of a new field location at Cortez, Colo.

Before joining Schlumberger in 1937, Forsythe had been employed by General Electric, Ford Motor Co., and Paraffine Cos., Inc. He served as assistant area manager in Canada from 1950 to 1952 and was manager of the Kansas division from 1953 to 1955.

Miller served as a field engineer in Ardmore and was manager of the Duncan location in 1947. He was manager of the Oklahoma City district in 1951 and was later promoted to assistant to the Oklahoma division manager. From 1954 to November 1955 he served as assistant Kansas division manager.

G. F. Chambliss will be in charge of the new station at Cortez.

Gaso Pump Names Pump Engineering as Distributor

Gaso Pump & Burner Manufacturing Co., Tulsa, has appointed Pump Engineering Co., Wichita Falls, Tex., as exclusive distributor for its products in the North Central Texas area.

Manager of the new distributing company is Ollie Blodgett, and assistant manager is Lee Sherwood, both qualified to apply technical knowledge to pumping problems by training that includes 15 years' experience in the purchase, engineering, and application of water flood, salt-water disposal, and pipeline pumping equipment.

BLODGETT

LEE SHERWOOD

Pump Engineering Co. will maintain a complete stock of Gaso parts and provide service and maintenance on all Gaso equipment.

Failing Sales Organization Attends Annual Meeting

Branch managers, field representatives, and sales representatives of George E. Failing Co., of Enid, Okla., manufacturers of portable drilling rigs, attended a 3-day annual meeting at the home plant in Enid in January. In the picture, seated, left to right: J. T. Tucker, Enid, vice president, sales; Paul Courtney, Enid, president; E. L. Alexander, Enid, vice president, manufacturing and engineering. Standing: Clyde Baker, Denver representative; V. C. Mickle, Enid, manager, water-well division; Jack Felton, Enid, special sales representative; Dick Miles, manager, Houston branch; Bud Floyd, manager, Midland branch; Jimmy Helton, Edmonton, Alta., manager, Canadian operations; W. L. Buller, Enid, sales manager.

Pacific District of PESA To Meet in Los Angeles

Annual meeting of the Pacific district of Petroleum Equipment Suppliers Association will be held in Los Angeles, February 16, Wendell M. Jones, chairman of the district's board of directors, announced recently.

Sam F. Bolby, vice president in charge of the western division, Shell Oil Co., will speak on the subject, "Oil Conservation in California."

Also slated to attend the meeting and address the group are M. E. Montrose, vice president, Hughes Tool Co., Houston, and Rainey Elliott, general manager, Jones & Laughlin Steel Corp., Supply Division, Tulsa. Montrose is president and Elliott vice president of the national association.

Mattco Moves Houston Plant to New Building

Mattco, Inc., has announced the removal of its plant and office to a new and modern building in Houston. The new facility is located at 219 Baywood Street.

Victoria Bank Announces New Directors, Other Shifts

The board of directors of the Victoria Bank & Trust Co., through its president, D. E. Blackburn, announced the following changes after its recent meeting. The new directors, Robert P. Dunn and Robert J. Hewitt, were added to the board of the bank. Dunn is a former partner in Dunn & Fowler, insurance brokerage firm, New York. He has been a resident of Victoria for the past 5 years. A native of Rockport, Tex., Hewitt has been a resident of Victoria for the past 8 years.

Charles Scott Hanley, business-development department, was promoted from assistant vice president to vice president. Perry Wendtland, farm loan officer, was promoted from assistant cashier to assistant vice president. Lynn Loyd, manager of the bookkeeping department, was promoted from assistant cashier to assistant vice president. Berry Colvin, business-development department, was promoted from assistant cashier to assistant vice president.

The stockholders authorized an increase in the capital stock from $1,250,000 to $2,000,000 by the issuance of 37,500 additional shares of stock.

Unit Rig Announces Boosts For Six Key Personnel

Promotions of several key personnel for Unit Rig & Equipment Co., Tulsa, have been announced by Kenneth Davis, Jr. John Tullis, former technical staff assistant to the president, has been

JOHN TULLIS

SOUTHWARD

named general works manager and is in charge of all plant operations. C. F. Southward has been appointed admin-

CAMPBELL

RINGWALD

istrative manager, sales department, and will be located in Tulsa.

Vann Campbell replaces C. F. Southward as district manager in West Texas.

R. P. SMITHEY

T. J. PERRY

A. S. Ringwald has been moved to Houston as district sales engineer.

R. P. Smithey, former sales order manager, is now sales-promotion manager. T. J. Perry is now general merchandise manager.

H. E. MOYER

MESSENGER

Davis also announced the establishment of an Oklahoma-Kansas district office in Oklahoma City. H. E. Moyer continues as district manager. The Rocky Mountain district office, formerly located in Casper, Wyo., has been moved to Denver. W. H. Messenger continues as district manager.

Tullis has been with the company since 1951, and Southward has been with it since 1945. Campbell was transferred from Houston, where he was sales engineer for the Gulf Coast area. Ringwald has been in Tulsa as project and sales engineer since joining the company in 1954.

Smithey joined the company in 1948. Perry's former position was manager of pricing and billing.

Wire-Line Service Firm to Occupy New Plant

A new wire-line service company will begin operations in the Gulf Coast region this month when Great Lakes Petroleum Services, Inc., opens the doors of this new building on Robin Road, Houston.

The plant will include administrative offices, electronic laboratories, equipment proving areas, and shop facilities for design and assembly of wire-line tools. Construction of tools is currently under way, and trucks are being equipped for bullet and jet perforation, which will be the first of a complete line of services to be offered by Great Lakes.

Headed by Red Hancock, Jr., the new company is a subsidiary of Great Lakes Carbon Corp., of New York. Robert W. Smith is vice president and sales manager.

Until the new plant, located off Almeda Road near Pierce Junction, opens late in February, administrative offices will remain in the Prudential Building, Houston.

Fisher Made Field Engineer By Du Mont Laboratories

The appointment of Robert W. Fisher as field sales engineer for mobile radio sales of Allen B. Du Mont Laboratories, Inc., has been announced by Fred M. Link, director of operations for Du Mont mobile communications. Fisher will be responsible for field service engineering and maintenance of Du Mont mobile radios.

Fisher has a 25-year background in radio communications. He is a licensed first-class radio-telephone operator and was employed several years in installation and servicing of base and mobile communications by Advanced Electronics Co. of Staten Island, N. Y., and by the United States Army at Fort Wadsworth. He next joined Link Radio Corp., where he became field engineer covering the entire United States.

R. L. Waller Joins Rodman Supply Co.

R. L. WALLER

R. L. (Les) Waller, former Fort Worth division sales manager of National Supply Co. and recently vice president and assistant general manager of Empire Machinery Co. in Odessa, has been named assistant general manager of Rodman Supply Co., Odessa.

In making the announcement, Rodman General Manager Bob French said, "We feel fortunate in acquiring Waller's services. His 19 years of experience will be helpful in all future development of our company."

The supply firm operates four stores in Texas and New Mexico and is in the process of opening an additional store in Oklahoma.

Otis Names Ellis to New Iberia Division

Otis Pressure Control, Inc., has announced the appointment of Bill J. Ellis as a caliper engineer in its New Iberia, La., division. Ellis formerly was in the firm's Longview, Tex., division office and also has been stationed at Otis' branches in Houston and Victoria, Tex.

Ellis joined Otis in 1950. He formerly worked for Gulf Oil Corp. in Odessa, Tex.

"The Golden Foot" is coming up!

During 1956 Core Lab will analyze its *millionth foot of core*. The sample may come from a well in Canada, or East Texas, or Venezuela. It may be one of hundreds of feet of core shipped thousands of miles from Saudi Arabia to Dallas.

It may be analyzed in Midland, New Orleans, or Farmington — or in any one of Core Lab's thirty-three permanent installations servicing all active drilling areas. While this event will be duly celebrated throughout Core Lab, processing the millionth foot will represent a momentous endorsement of core analysis as a basic science in the optimum development of reserves.

The first foot of commercial core analysis was performed to supply the missing link of reservoir information between "a rainbow on the slush pit" and non-quantitative measurements. Today, as we approach The Golden Foot, there is still no adequate substitute for surface evaluation of the basic product — the formation and its contents.

CORE LABORATORIES, INC.
801 CORE STREET, DALLAS, TEXAS

CORE LAB
PETROLEUM RESERVOIR ENGINEERING

DALLAS, HOUSTON, CORPUS CHRISTI, MIDLAND, ABILENE, SAN ANTONIO, TYLER, LIBERAL, FT. WORTH, WICHITA FALLS, SHERMAN, OKLA. CITY, TULSA, ARDMORE, BARTLESVILLE, PAMPA, ARK. CITY, GT. BEND, NEW ORLEANS, SHREVEPORT, HATTIESBURG, LAFAYETTE, DENVER, BAKERSFIELD, CASPER, BILLINGS, WORLAND, STERLING, EL DORADO, LUBBOCK, FARMINGTON, LOVINGTON, MONAHANS, SAN ANGELO, CALGARY, EDMONTON, REGINA, VENEZUELA, S. A.

EXPLORATION

Wherein a would-be wildcatter is told where to look for his oil field

Dear John:

So you finally lined up some dough. Now, you want to start looking for that oil field you've promised yourself all your life. Well, bud, you asked me where to start, and I'm going to tell you, but let's have it understood that your first hole (and possibly your second and third) stands a good chance to come a cropper. But you asked, "Where's the best chance in Texas for a wildcatter to sink some wells at medium cost, with a fair chance of success—some place where everybody and his dog haven't already been?".

That's easy, son. Remember when you and I used to write those books on the oil fields of Texas? We wanted to cover the "hot" counties, and at that time, if you recall, the Panhandle counties were as cold as a clam. So we shied away from them. But look what's happened in the last 3 years. There's no hotter place in the nation now than Ochiltree County. Last year it was Hansford. Next year it'll be Lipscomb. Those are all in the northeast corner, on the west flank of the Anadarko basin.

Now look to the south, boy. I drew this map to make it easier for you. Between the Matador arch on the south, and the Amarillo uplift on the north, there's a king-size basin. Palo Duro it's called—some call it Plainview. Now get out your ownership map of the Panhandle. How many wildcats do you see in those counties that are shaded here? Not many; one in this county, two in that one, even five in a few. What kind of exploration is that? Wouldn't you say that we've been neglecting this basin, geologically one of the most encouraging in the country for oil and gas? It's got everything, John—Permian and pre-Permian rocks up to 11,000 ft. thick, big buried domes and anticlines all around its flanks, and 32,000 sq. miles for you to play in. It's lonesome country, flat in places, rough in others, and you won't find many temptations to sin out there. But there she sits, right smack between two of the most active oil plays in the world.

After all, **Palo Duro is nothing more than the northern lobe of the great Permian basin**—the sea covered all this land, and more than half the total sediments there are Permian in age. The deeper ones are Pennsylvanian (good chance for reefs there), Mississippian, and granite wash in the low places on the pre-Cambrian floor. And if for some strange reason you want to get outside Texas, the thing extends westward for another 125 miles into northeastern New Mexico. The Ellenburger might also offer possibilities, especially in the eastern part (they found it productive up in Gray County last year, you know), but it's probably spotty out to the west. Not too much indication of Devonian or Silurian deposition in the basin so far, but with the small amount of drilling that's been done, we can hardly say it's not there.

"Look to the south . . . How many wildcats do you see in those counties that are shaded? . . . What kind of exploration is that?"

They've found several fields around the buried peaks that make up the Matador arch on the south. The oil comes from the Clear Fork. And I see no reason why the same thing might not be found on the buried uplifts on the northern shelf area of Palo Duro—see the single small field on Bush dome? How about the Bravo dome, the Armstrong anticline, and the big anticline that splits Hall County in two, northwest to southeast?

Offhand, I'd say the best hunting will be in the eastern part of the basin; lots of black shales there, and you know what that means—source beds and sealing factors. Farther out toward the "hinge" line, there should be Pennsylvanian reefs as well developed as those in Scurry.

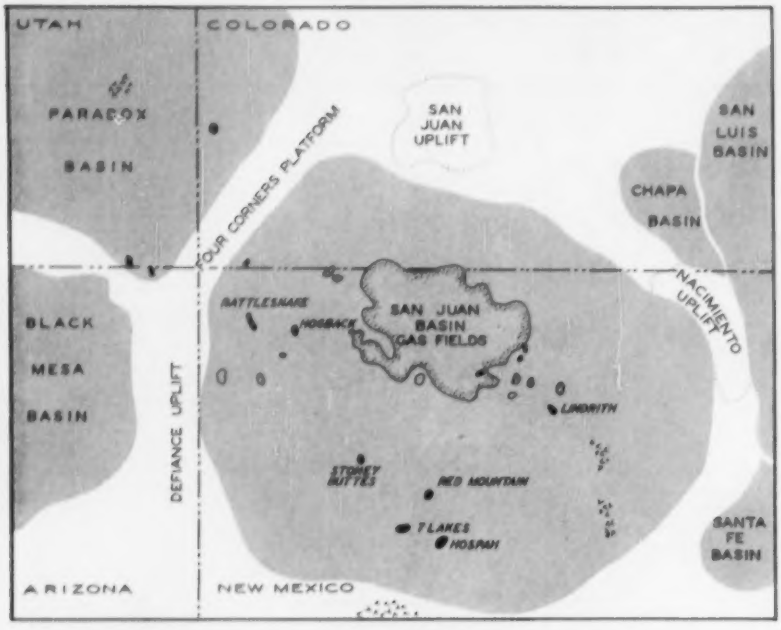
Now, how are you going to find them? Well, the best answer is the seismograph. Those boys are performing new wonders in geophysical interpretation these days, and with the high-resolution tools and magnetic recording, they're reaching a new peak of efficiency in structure spotting. And don't forget, some of those "dry" wildcats in Palo Duro had oil stains and some shows. And fracturing is making oil wells out of holes that found nothing more than a stain years ago. It's worth looking into. But remember, you've got to go deep—don't stop short of the pre-Cambrian basement.

It takes aggressiveness to open oil provinces. All the great oil fields in this world have been opened by folks with crazy ideas. Their cohorts called them fools. Until they hit, that is. Then they were "pioneers." The list is long—Drake, Williams, Higgins, Joiner, and a host of others. But there's a great need for fools today, John.

We keep crying over the growing "shortage" of places to drill. But right here in our own backyard sits one of the best hunting grounds we cou'd want. What are we yelling about? Some day, some fool is going to bring in a well in Palo Duro; then all the other fools will jump in behind him and swear they knew it all along. That won't keep them from paying a rancher three times as much for a lease as he'd ask now, though. It's going to happen, John. And when it does, Palo Duro will be hotter than the downtown business section of Hades.

Yours for good hunting,

Frank J. Gardner



Historically speaking . . .

The San Juan basin is one of the oldest oil-producing areas in New Mexico. Oil was discovered accidently in 1911 while drilling a water well in the Seven Lakes area.

Development of the oil and gas resources of the basin has been extremely irregular. Not until the recent development program (started in 1952) has there been a really extensive and prolonged effort. New oil and gas discoveries during 1921-1922 and again in 1935 stimulated activity for a time, but these plays quickly died out.

Greatest deterrents to early development of the area were poor roads and transportation, an extremely limited local market, and the impossibility of competing with distant market areas already served by the flush production of California and Texas.

Here's a review of the areas and sands that are paying off as . . .

San Juan Basin Fulfills Its Promise

by Frank C. Barnes

THE San Juan basin consists of San Juan, Rio Arriba, McKinley, and Sandoval counties in New Mexico. It includes practically all of northwestern New Mexico and extends northward into Colorado. In length, the basin extends from Gallup, N. Mex., to Durango, Colo., a distance of 125 miles. Its average width is about 100 miles. The total area of the basin is about 12,000 to 15,000 sq. miles. The San Juan basin is entirely within the Colorado Plateau's physiographic province, and most of the bordering mountain ranges are part of or related to the southern Rocky Mountains.

General structural features . . . The San Juan basin is both a structural and topographical depression which in general cross-section approximates the shape of a broad, shallow bowl. Along the outer edges of the basin, the sediments are upturned and faulted as they rise to form the flanks of the bordering mountain uplifts. But in the central portion, the beds are relatively flat.

The structural and depositional history of the San Juan basin is closely related to the southern Rocky Mountains. In fact the basin can be considered as a structural embayment into the Rocky Mountains.

The north and east sides of the basin are generally more complex structurally. The San Juan Mountains and the outlying La Plata Mountain laccoliths form a distinct north border with a southward dipping monocline into the central basin. The Nacimiento uplift forms the eastern border which is complexly faulted and thrust westward, but with a general westward dip into the basin. The Brazos uplift and the Chama embayment form an extension of San Juan basin to the northeast.

Along the southeastern border, the basin merges with the highly faulted west side of the Rio Grande trough and the Lucero uplift. The southern border is marked by the prominent east-west trending Zuni Mountain uplift. There is a wide, north dipping platform between the Zuni uplift and the central basin.

On the west, the basin is bordered by the broad, gently dipping defiance uplift in Arizona. The northwestern border is indistinct and there is no major uplift, but rather a broad platform that separates the San Juan basin from Paradox basin.

One of the prominent structural features is the Hogback monocline that borders the basin on all sides except the south and southwest.

General geology . . . The rocks exposed in and bordering on San Juan basin vary in age from pre-Cambrian granite and metamorphics to Tertiary sediments and volcanics. As a rule, the older rocks are exposed along the borders of the basin and in the major uplifts. The sediments become progressively younger towards the central basin. In the central portion of the basin, there is a probable thickness of 14,000 ft. of sediments. Volcanic plugs, dikes, and lava flows are a prominent feature in many parts of the area.

Pay zones . . . As of December 1955, commercial oil and gas has been produced from sediments of Mississippian, Pennsylvanian, Jurassic, Upper Cretaceous, and possible early Tertiary age.

Oil and gas has been produced from folded anticlines and domes, fault structures and stratigraphic traps. The largest known reserves and principal production is from stratigraphic-type entrapment, which is very extensive in San Juan basin.

Author is consulting geologist, Santa Fe, N. Mex. Paper presented at the general session of the Interstate Oil Compact Commission, in Santa Fe.

Mississippian: The Ouray-Leadville limestone series are the oldest rocks that have produced oil or gas in the basin. The Ouray limestone is considered of Devonian age in its lower portion, but it contains Mississippian beds that merge with the Leadville limestone. The series is 150 to 200 ft. thick and has produced 65°-gravity oil at Hogback.

Pennsylvanian: These rocks in San Juan basin are producing 42-gravity oil at Rattlesnake and Hogback and gas at Barker Creek. The Pennsylvanian rocks are thin or missing along the north and northeast edges of the basin along the border of the Uncompaghre-Sangre de Cristo land mass and also along the south side bordering on the Defiance-Zuni land mass—both of which existed in Pennsylvanian times. Pennsylvanian rocks, where present, are from 2,000 to 5,000 ft. thick.

Jurassic: The Media-Entrada oil pool, producing 33°-gravity oil from the Entrada sandstone, was discovered during 1953. This is the only Jurassic oil production at present, but there have been other oil and gas shows in the Entrada at scattered localities. Oil and gas shows have also been reported from the Morrison formation.

Upper Cretaceous: These sediments have always been the mainstay of both exploration and production in San Juan basin. Upper Cretaceous sediments are of marine, paludal, and continental origin and average 7,000 to 8,000 ft. in thickness. The Dakota sandstone, Mancos shale, Mesaverde formation, Pictured Cliffs sandstone, and the Kirtland-Fruitland shale section have all produced oil and gas. Oil is usually of high gravity or is produced as distillate along with the gas.

The Dakota sandstone produces or has produced oil and gas in the Angels Peak, Barker Creek, Blanco, South Blanco, West Blanco, West Kutz, Hogback, Huerfano, Huerfanito, Lindrith, Stoney Butte, Rattlesnake, Table Mesa, Ute Dome, and Companero pools. The oil is usually of high gravity or is a distillate.

The Mancos shale produces oil from the Tocito sand lense at the South Blanco Tocito pool. It has also produced oil and gas from a sand in the lower porton (Gallup or Sanostee) at several localities.

The Mesaverde group produces or has produced oil at Hospah, Red Mountain, Stoney Butte, Torreon, and Seven Lakes pools. The large Blanco gas pool produces from the Mesaverde and also produces gas distillate at the Twin Mounds pool. The Blanco Mesaverde gas pool is now roughly 65 miles long and over 50 miles wide.

The Pictured Cliffs sandstone is another of the major gas-producing zones in San Juan basin. The Pictured Cliffs sandstone produces gas at the Aztec, Ballard, Blanco, South Blanco, East Blanco, Canyon Largo, West Kutz, and Fulcher-Kutz pools.

AGE	FORMATION		REMARKS
EOCENE AND PALEOCENE	WASATCH		
PALEOCENE AND UPPER CRETACEOUS	NACIMIENTO TORREJON & PUERCO		
	ANIMAS OJO ALAMO		
UPPER CRETACEOUS	Mc DERMOTT		
	KIRTLAND FARMINGTON		FARMINGTON PRODUCES GAS OR OIL AT AZTEC BLANCO BLOOMFIELD AND HYPER
	FRUITLAND		
	PICTURED CLIFFS		PICTURED CLIFFS PRODUCES GAS AT BLANCO GAVILAN KUTZ CANYON FULCHER BASIN AND ROSA
	LEWIS		
	MESAVERDE CLIFF HOUSE MENEFEE POINT LOOKOUT		MESAVERDE PRODUCES OIL OR GAS AT BLANCO HOSPAH KUTZ CANYON FULCHER BASIN LA RED MOUNTAIN SEVEN LAKES AND STONE BUTTE
	MANCOS		MANCOS SHALE HAS PRODUCED SMALL QUANTITIES OF OIL AT CROMO MANCOS CREEK AND RED MESA
	DAKOTA		DAKOTA HAS PRODUCED OIL OR GAS AT ANGELS PEAK BARKER CREEK HOGBACK LINDRITH PROD RATTLESNAKE TABLE MESA AND UTE DOME
JURASSIC	MORRISON		
	SAN RAFAEL GROUP	SUMMERVILLE	
		WANAKAH	
		ENTRADA	
		CARMEL	
	GLEN CANYON GROUP	NAVAJO	
		KAYENTA	
		WINGATE	
TRIASSIC	CHINLE		
	SHINARUMP		
	MOENKOPI		
PERMIAN	CUTLER		
	RICO		
	HERMOSA		
PENNSYLVANIAN	PARADOX		THE PENNSYLVANIAN HAS PRODUCED OIL OR GAS AT BARKER CR DOME CR RATTLESNAKE & UTE DOME
	MOLAS		
MISSISSIPPIAN	LEADVILLE		THE OURAY-LEADVILLE SERIES HAVE PRODUCED SUBSTANTIAL GAS SHOWS AT RATTLESNAKE & TOCITO DOME THIS GAS IS HIGH IN HELIUM
DEVONIAN	OURAY		
	ELBERT		
CAMBRIAN	IGNACIO QUARTZITE		
PRE-CAMBRIAN			

Oil and gas have been found in the Mississippian, Pennsylvanian, Jurassic, Upper Cretaceous, and possible early Tertiary age rocks in the San Juan basin.

Tertiary: One well along the east side of the basin in the Lindrith area has produced gas from a sand lense believed to be in the lower Tertiary. But the extent or eventual significance of this discovery is not known at present.

Production . . . During 1954 the various age groups produced oil and gas as outlined below:

	Oil bbl.	Gas, M.c.f.
Upper Cretaceous	996,368	136,014,000
Jurassic	9,827	0
Pennsylvanian	28,650	10,469,900
Mississippian	0	0
	1,034,845	146,483,900

Total oil and gas production in the San Juan basin has increased steadily for the past 5 years.

And the future? . . . San Juan basin, neglected for almost 40 years, is now the major gas-producing area of the Rocky Mountain petroliferious province. It is no longer necessary to predict a bright and promising future, as so many have done in the past. The bright future is here.

Yet the ultimate in productive possibilities has by no means been reached. Continuous exploration will undoubtedly result in additional oil and gas discoveries, particularly in the deeper horizons below the Upper Cretaceous. Oil production in San Juan basin should continue to increase through new discoveries for many years.

With two pipeline outlets leading to almost unlimited outside markets, the gas-development program should continue at a high level for at least 2 and possibly 3 more years.

The development of pipeline facilities from San Juan basin to the West Coast has already stimulated additional exploration in Arizona, Utah, Nevada, Idaho, and in Oregon and Washington. This exploration for new gas areas is due principally to the reserves developed in San Juan basin which are sufficient to support the long and costly pipeline projects of El Paso Natural Gas Co. and Pacific Northwest Pipeline Co.

It is highly probable that entirely new and heretofore wildcat areas will be developed along the route of the two gas lines. Basin oil and gas production is still only beginning. It will ultimately profit much of the West.

GUIBERSON'S IMPROVED TYPE H1 ANCHOR

features

GREATLY REDUCED SLIP WEAR

TYPE H1 ANCHOR

Here is the anchor most widely used by oilmen everywhere — now, with a great new feature. Stainless snap rings hold the slips in retracted position while going in yet have no effect on holding power of the anchor. This new feature gives far longer slip life because slips do not drag the casing wall. Slips with the snap ring are interchangeable on all Guiberson H1 anchors.

There is nothing on the market that will excel Guiberson's Type H1 Hydraulic Anchor for holding down any packer. It *automatically* sets when pressure in tubing overcomes casing pressure. We recommend it for holding down your packer in acidizing, fracturing or other below packer pressuring operations. It holds equally well in any direction.

Simplicity of design and completely automatic operation make the H1 exceedingly easy-running, easy-pulling. Case hardened piston slips in monel inserts assure positive action and maximum corrosion resistance. H1 anchors are individually tested and will hold any pressure the tubing will stand.

See this improved Type H1 Anchor for yourself. Use it on your next completion or workover. Write for data, sizes and prices.

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Sold By Leading Oil Field Supply Stores Everywhere

Three exploratory trends are developing in Beaver County, Oklahoma Panhandle. The new areas of promise are: East Camrick, Dower, and Harris; the area south of Southeast Mocane, and the South Elmwood area.

Beaver County Still Making Oklahoma News . . .

. . . as 1955 discoveries open three promising 1956 trends

by John C. McCaslin

WITH one of its most significant discovery years behind it, Beaver County in the Oklahoma Panhandle remains at the top of the success list in the Hugoton embayment exploratory race.

1955 discoveries . . . Exploration in Beaver County last year came up with nine widely separated new oil and gas-condensate reservoirs.

. . . Southwest. Colorado Oil & Gas Co. opened Madison-Morrow gas field in 2n-27eCM in the southeastern portion of the county. Further development in this area has been unsuccessful. Union Oil Co. of California drilled 1 Bourquin in 1n-26eCM in the latter part of 1955. After considerable testing the well was finished as a dry hole.

. . . South-Central. Northwest Elmwood field in the northeast corner of 2n-23eCM was the most significant strike of the year. Union's 1 Parker got good gas-condensate production from the Morrow sand. The company is drilling an offset to this discovery.

. . . Southwest. Four new producing areas were opened in the area east and northeast of the Camrick and Grand Valley areas.

Warren Petroleum Corp. opened Morrow oil production at East Camrick in 1n-20eCM. The company's 1 Harris opened a Morrow oil and gas area in 1n-21eCM. The East Camrick discovery well flowed 15 bbl. of oil per hour from the Morrow.

Dower field, a Sunray-Mid-Continent Oil Co. Morrow oil discovery, was opened in 28-1n-21eCM. Offsets to both the Harris and Dower discoveries are under way.

Union Oil Co. of California moved into a relatively untested area of the county, 10 miles northeast of Grand Valley field, to open a new Morrow producing area at 1 Frantz in SW NE 10-2n-21eCM. The company is conducting tests at this strike.

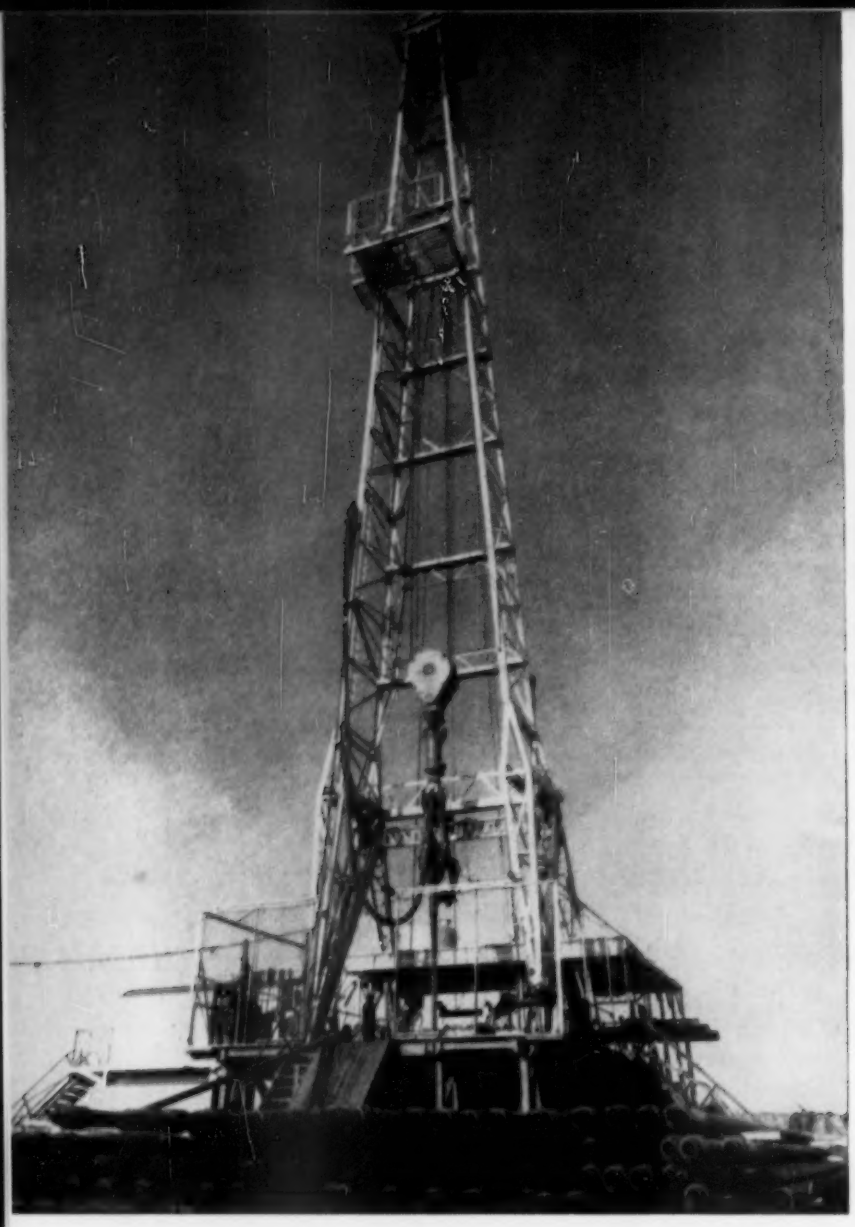
. . . North-Central. Cities Service Oil Co. made a significant strike in the county last year at the 1 Miles, discovery well of West Timber Creek field in SE SE NW 12-4n-24eCM. The well made 60 bbl. of oil per day from the Marmaton-Des Moines-Pennsylvanian. Morrow gas-condensate production was later added to the West Timber Creek area. Other Morrow pools were opened in the Forgan, Knowles, and South Glenwood areas.

Open three promising 1956 trends . . . One month of intensified 1956 exploratory drilling has set the pace for development of three new trends in Beaver County.

. . . Southwest. Offset drilling is under way in the East Camrick, Harris, and Dower areas in the southwestern part of the county. Magnolia Petroleum Co. is extending East Camrick at 1 Stewart in C SE SE 16-1n-20eCM. The well has indicated Morrow oil production at 7,210-21 ft. The offset is northwest of the 1 Bowles discovery. Drilling is also under way at the east offset to the Harris discovery. Union is testing at its 1 Frantz discovery with production promised from the Morrow sand.

. . . North-Central. In late January The Texas Co. opened a Mississippian-Chester gas pool at 1 Gulf Coast Western-A in C SW NE 9-5n-24eCM. This West Mocane area strike flowed 16,340 M.c.f. of gas per day through open 2-in. tubing from 6,410-32 ft.

In the West Timber Creek area



Designed for speed in drilling, this rig drilled 7,400 ft in 16 days at a location near Lindsay, Oklahoma. Carrying 40,000 lb of weight at the bit, it was pumping 641 gallons of mud a minute at 1,800 lb pump pressure to pulverize sand and rock and increase the drill's boring speed.

Roughnecks stab the tool joint into the waiting end as another length of drill pipe goes into the hole.

Power-Play For Oil

Mercury Drilling Company—searching for new reserves —uses one of the most powerful rigs ever built to thrust Pittsburgh Steel Company drill pipe into the earth.

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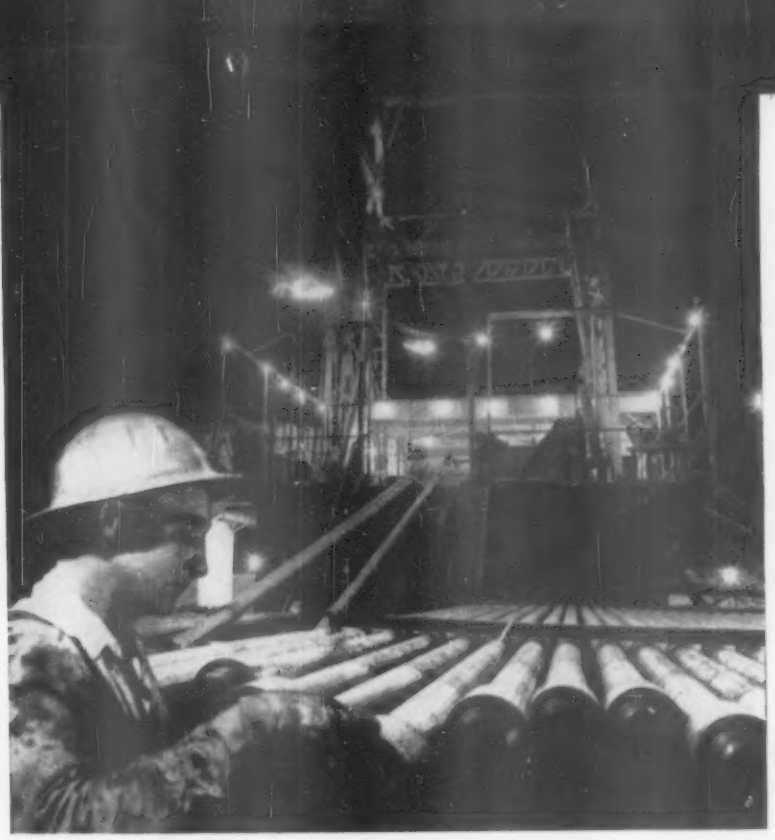

Drill pipe, being measured in the rack, is fed into the hole length by length as the hole deepens. On a rig such as this it must withstand severe tension, compression, torsion and fatigue stresses as well as abrasive wear.

Grade E Range 2 drill pipe—is supplied by one of the independent distributors listed at right. Already a pace setter, it is hungrily churning after new footage records.

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United Producing Co. 1 Mayo flowed 4,500 M.c.f. of gas per day from the Morrow sand through perforations at 6,778-92 and 6,800-56 ft.

Cabot Carbon Corp. 2 Barby-B in SW SE NW 27-4n-25eCM is a dual producer, opening a new gas pool south of the Southeast Mocane area. The well flowed 5,600 M.c.f. of gas daily from the Morrow sand; from the Chester it made 10,000 M.c.f. per day. A north offset to this discovery is drilling.

Other north-central Beaver County developments include: Kerr-McGee Oil Industries, Inc. 1 Raymond in C SW NW 31-6n-25eCM, Northwest Mocane field, flowed 248 bbl. of oil in 21 hours through ½-in. choke from Hodges-Checkerboard lime. The 2-B Adams in C NE SW 36-6n-24eCM, flowed 3,120 M.c.f. of gas per day from the Marmaton.

...South. Orville H. Parker 1 Pruett is a Thirteen Fingers lime-Pennsylvanian oil discovery in southern Beaver County. The well, located in C SE NW 30-2n-24eCM, flowed 106 bbl. of oil in 20 hours from perforations at 7,464-80 ft.

Last week gas-condensate production was added to this significant new area at Parker's 1 Sleeper in C NW SE 25-2n-23eCM, southwest of the Pruett discovery well. The well flowed 7,120 M.c.f. of gas per day and some distillate spray on test of the Morrow sand at 7,661-73 ft.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

Success Indicated at Hansford County Wildcat

Humble Oil & Refining Co. has an indicated Morrow sand discovery in Section 108, Block 45, H&TC Survey. The Hansford County wildcat, the 1 Hansford Gas Unit, flowed at the rate of 3,000-4,000 M.c.f. of gas per day with recovery of 45 ft. of distillate from the Morrow at 7,237-68 ft.

OKLAHOMA PANHANDLE

Free Oil Swabbed at New Beaver Prospect

Magnolia Petroleum Co. swabbed 103 bbl. of new oil in 48 hours from perforations in the Morrow sand at 7,284-7,300 ft. at the 1 Snell, an extension try to a new field in southwestern Beaver County.

The well is in C SE SE 22-1n-20eCM.

In Grand Valley field, on the Beaver County side, Atlantic Refining Co. and E. L. Cox 1 Flowers Unit "B," NE NE SW 8-1n-20eCM, will be completed as a prolific Morrow sand oil well. The new producer flowed 121 bbl. of oil in 6 hours on ¾-in. choke after fracture treatment of perforations at 6,990-7,002 ft.

Gas-Condensate Hit Reported in Beaver

A new oil area in south-central Beaver County has a gas-condensate producer indicated. It is Orville H. Parker 1 Sleeper in C NW SE 25-2n-23eCM, southwest of the discovery well in the area.

The Sleeper well flowed 7,120 M.c.f. of gas per day and a distillate spray on test of the Morrow sand at 7,661-73 ft. The discovery well of the new area was the 1 Pruett in C SE NW 30-2n-24eCM. It flowed 106 bbl. of oil in 2 hours on 14/64-in. choke from perforations at 7,464-80 ft. in the Thirteen Finger lime.

WESTERN CANADA

SASKATCHEWAN

Two Wildcats Promise New Southeast Pools

Two exploratory tests in southeast Saskatchewan being drilled by Imperial Oil, Ltd., have yielded very encouraging recoveries of oil during drill-stem testing operations in the past week according to unofficial reports. The new indicated producers which include a wildcat and a step-out test to previous production, are 19 miles northeast and 45 miles east-northeast of the town of Estevan respectively.

The wildcat test that gave further oil encouragement on latest drill-stem test is Imperial-Canadian Superior 13-26 Hirsch, LSD 13, 26-3-5w2. This test was reported as an indicated discovery last week. The latest drill-stem test reported gave further oil encouragement in the Charles zone of the Mississippian formation. During that test, bottomed at 4,853 ft., 800 ft. of gassy oil and 90 ft. of muddy gassy oil entered the drill pipe. There was no evidence of formation water on that test, whereas, the earlier tests in the same formation gave up small recoveries of salt water. Coring and testing operations are currently being carried out in the Mission Canyon sector at this wellsite.

The other indicated success, Imperial 4-9 Hastings, LSD 4, 9-4-33w1, is situated 1½ miles southeast of the Rio-Palmer-Crystal 5-12 Ritchie oil success, made its oil show from the Mission Canyon sector of Mississippian.

Initial test in that zone gave a gas flow of 1,850,000 cu. ft. daily, sprayed oil to the surface in 35 minutes and indicated a recovery of 30 ft. of muddy oil and 150 ft. of clean oil. Next drill-stem test, bottomed at 3,908 ft. unloaded 11 bbl. of clean oil from the drill-stem and after pipe was pulled, showed a further recovery of 200 ft. of clean oil.

Production casing has been set on the 4-9 Hastings venture and the well is standing until further evaluation tests can be carried out on it.

ALBERTA

Glauconitic Gas Well Completed in Carbon Area

Shell Oil Co. has completed another well in the Carbon area of central Alberta, as a gas producer from the Glauconitic sand after failing to find oil or gas in lower horizons.

This new well, Shell B-7-29 Carbon, is on LSD 7, 29-29-22w4. It lies 1½ miles southeast of the firm's Shell A-7-31 Carbon, Glauconitic gas discovery well which was drilled last year.

During a drill-stem test in the gas zone, around the 4,800-ft. mark, gas flowed to the surface in 1 minute and built up to a maximum flow of 4,910,000 cu. ft. daily. Pipe recovery consisted of 210 ft. of condensate cut, muddy, fresh water.

EASTERN INTERIOR

ILLINOIS

In Edwards County, 7 miles northwest of Albion, Calvert Drilling Co.-Barnsdall Industries have completed 1 Deischer, NE NE SW 29-1n-10e, for 250 bbl. per day. Three days after completion the well pumped 288 bbl. per day. The well is a O'Hara lime producer at 3,273-82 ft.

● In Jefferson County, The Texas Co. has set casing at 1 Green, NE SE NE 11-2s-4e, to test the Aux Vases at 2,860-05 ft. This well is more than 1 mile from production.

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New pays and widely scattered pools get

West Texas Off to Good Start

All areas promise new work

by Carl Hoot

WEST Texas operators are off to a good start this year, with all areas promising new work and further discoveries. Last week's developments included new pays and new pools in widely scattered areas.

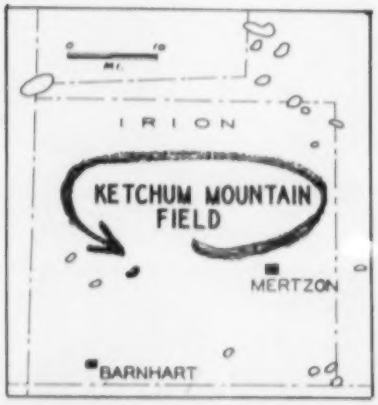
Sunray Mid-Continent was ready for completion at a Permo-Pennsylvanian strike in northern Upton County. On flow tests, its 1 Hazel Neal, Section 75, Block C, CCSD&RGNG Survey, made 233 bbl. of oil a day through ¾-in. choke from perforations at 10,000-10,026 ft. Gravity was 43° and flowing pressure was 100 psi.

Location of the well is on a 1,600-acre lease. Sunray Mid-Continent holds approximately 9,000 acres in the area.

Clear Fork Discovery

Phillips Petroleum Co. has dually completed its 66 University from the upper Clear Fork and from the Tubb zone, and has asked for discovery allowables on both pays, and new field designations. Location is in Section 12, Block 11, in the southern portion of Martin field, where production ranges from the San Andres to the McKee.

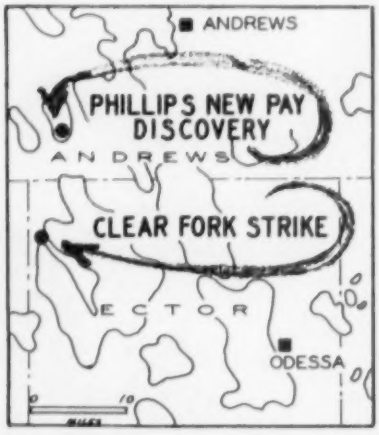
Potential on the Clear Fork was 409.8 bbl. of 41° oil a day, through ¼-in. choke, from perforations at 5,712-61 ft. Gas-oil ratio was 1,417:1. Operators fractured the section with 20,000 gal.



Ketchum Mountain field in Irion County gained a good flowing confirmation producer.

An earlier completion was made from the Tubb zone (localized name for a mid-Permian member). Daily potential was 108.58 bbl. of 42° oil through 12/64-in. choke. Gas-oil ratio was 503:1. Perforations were between 6,260-6,320 and 6,344-80 ft.

Wolfcamp discovery by Texaco . . . The Texas Co. opened a new Wolfcamp producing pool along the southeastern flank of Central Basin platform at its 1-A J. H. Shirk estate.

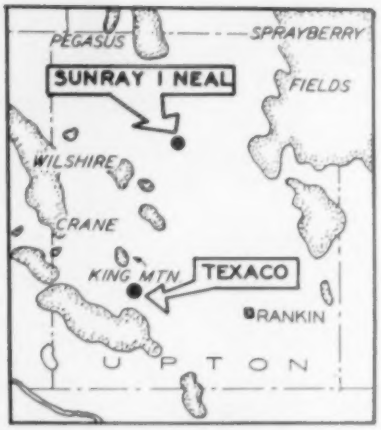


Clear Fork and Tubb pay zones were opened in Martin field, Andrews County, and a new Clear Fork discovery was brought in northwest of Goldsmith field, Ector County.

Initial production was 160 bbl. of oil a day from perforations at 7,170-90 ft. This well was drilled to 11,098 ft., then plugged back to 7,220 ft. after testing the lower formations. At this report, formation tops had not been disclosed

Location of the well is about 2½ miles south and slightly east of Ellenburger production in King Mountain field. Texaco is said to have leased 3,200 acres in the area.

Ector County gained an upper Clear Fork discovery at McDonald Oil Corp. and W. B. Goddard 1 Cummins, in 20-45-T1N-T&P Survey. Location is 6 miles northwest of Goldsmith and on the northwest flank of Goldsmith field.



Sunray Mid-Continent opened a Permo Pennsylvanian pool at 1 Neal, northeast of Wilshire-Ellenburger and Amacker-Pennsylvanian fields. The Texas Co. 1 Shirk opened Wolfcamp pay south of King Mountain-Ellenburger field.

Suggested new-field name is Goldsmith, West (upper Clear Fork).

On final test the well flowed 218.74 bbl. of 37° oil a day through 18/64-in. choke. Perforations were at 5,640-66 ft. Gas-oil ratio was 712:1.

Clear Fork in Irion County

Net production from the Clear Fork formation has never been outstanding, but it has taken on new importance since operators started recompleting wells to that pay zone in the Spraberry Trend fields. In many areas, the Clear Fork is the main drilling objective.

Confirmation production from the Clear Fork has been made in the Ketchum Mountain pool of west-central Irion County. Sinclair Oil & Gas Co. 1 John Scott, a long west offset to the firm's pool discovery, flowed 623 bbl. of 40.5° oil a day through ½-in. choke on completion test. Pay was fractured through perforations at 4,497-87 ft. with 7,000 gal. of oil and 10,500 lb. of sand. Flowing tubing pressure on completion was 190 psi.

The discovery, 1 Ella Sugg, was completed last August for 129 bbl. of oil a day through 16/64-in. choke, from perforations at 4,414-24 ft. An east offset to the discovery completed as a gasser, plus a small amount of distillate. Potential was 2,900 M.c.f. of gas, and pay was at 4,204-14 ft.

Runnels County New Pay

Humble Oil & Refining Co. has opened Goen limestone pay in the Rowena field in southern Runnels County.

On flow test at 3,940-70 ft., oil surfaced in 59 minutes, flowing at the rate of 690 bbl. a day. Flowing pressure was 675 psi., gravity was 51.7° and gas-oil ratio was 150:1.

GREAT LAKES

MICHIGAN

Carter Oil Co. completed another good Traverse oil well in Huber pool, Newaygo County, at its 1 Selby, SW SE NE 5-14n-14w, Denver Township. This new completion boosted total number of producers drilled in the pool to seven, third successful completion by Carter. Two failures have been drilled since the discovery, one by Carter off the extreme northeast edge of the field, and one by The Pure Oil Co. on the southeast side of the pool.

The new Carter well was rated good for 192 bbl. of oil a day, restricted flow after a 200-gal. cleanout acid treatment. Well flowed as much as 13½ bbl. of net oil per hour through a ¾-in. choke on initial tests after acidization.

● A pumping unit was being installed at O'Neill Oil Co. 1 Larson, SE SE SW 17-13n-9w, Deerfield Township wildcat, Mecosta County, where testing was in progress of Reed City zone oil pays. Well was reported to have logged oil shows at 3,582-84 ft., and at 3,603-07 ft. Water was also in evidence. Pay, cased off with a 4-in. liner, was perforated with 12 shots at 3,582-86 ft., and with 30 shots at 3,594-3,604 ft. After an initial treatment with 1,000 gal. of acid, well was unofficially reported to have produced 100 bbl. of net oil, plus an undetermined amount of water, in 3 days.

APPALACHIAN

EASTERN KENTUCKY

Located on Bowen Creek in Leslie County, the wildcat test of United Fuel Gas Co.-25 Fordson Coal Co. made 3 bbl. of oil daily at a total depth of 2,781 ft. Oil was had in the Corniferous lime section from 2,700 to 2,705 ft. after topping formation at 2,676 ft. Previously Mississippian Big lime was found at 1,877 to 2,163 ft. with no shows. Operators continue testing.

Located on Gilbert Creek, Leslie County, United Fuel Gas Co. wildcat 20 Fordson Coal Co. has been successfully completed. Corniferous lime 2,500 to 2,507 ft. yielded oil at the rate of 34 bbl. daily with an accompanying gas volume of 133,000 cu. ft. Rock pressure was 340 lb. at a total depth of 2,614 ft. in Silurian shale. Test was one of 25 wildcats drilled in the general area of Leslie and Clay counties on Fordson Coal properties.

OHIO

E. C. McManaway et al moved ⅔ mile north of their two recent producers in southeastern Eaton Township, Lorain County, and completed a combination well on Joe Vega in Lot 3. Clinton sand at 2,622-35 ft. gaged 600 M.c.f. with a show of oil natural and made 775 M.c.f. and 40 bbl. per day after fracturing.

● The third well in the extension to Black Run pool was completed as a 166 bbl. producer by Pure Oil Co. on 1 (2) C. J. Frazier, Section 23, Jackson Township, Muskingum County. Clinton sand was found at 3,013-66 ft. with only a fair showing before fracture treatment.

● The known productive area of the large Flint Ridge pool was widened ½ mile at one point along the south side by Pennoco Investment 1 (2) Ed Vincent, Section 10, Hopewell Township, Licking County. In a 24-hour test after treatment the well gaged 50 bbl. from sand at 3,140-3,179 ft.

PENNSYLVANIA

In Banks Township, Indiana County, Southwest Pennsylvania, Columbian Carbon Co. 1831 Farmers & Miners Trust Co., reached the Onondaga 7,388-93 ft., the chert at 7,393 ft., and shut down at 7,398 ft., after running 7-in. casing at this depth. The rotary outfit is being dismantled.

WEST VIRGINIA

In Licking district, Tucker County, West Virginia, Hope Natural Gas Co. has located 9985 J. H. Ludwick, wildcat, elevation 1,710 ft., Belington Quadrangle, 1.15 miles south of latitude 39 degrees 15 minutes and .51 mile west of longitude 79 degrees 45 minutes.

● In Dry Fork district, Randolph County, Nelson W. Taylor, Agent, for Ben Franklin Oil & Gas Corp., has started drilling operations in 1 H. R. Tingler, elevation 2,914 ft., Horton Quadrangle, 1.09 miles south of latitude 38 degrees 55 minutes and 2.20 miles south of longitude 70 degrees 35 minutes.

MID-CONTINENT

OKLAHOMA

Completion Reported at Eureka Area Offset Well

Sunray-Mid-Continent Oil Co. has completed 1 Ancell in the Cherokee wedge area of Grant and Alfalfa counties.

The well, located in C SE NW 12-28n-9w, Alfalfa County, flowed 15,000 M.c.f. of gas per day with 19 bbl. of distillate per million on open flow potential test. Perforations were at 4,947-57 ft.

North Madill Report

Several wells in Marshall County's North Madill-Ordovician field are in completion states.

Sinclair Oil & Gas Co. 1 Sterling-Thompson in SE SE NW 15-5s-5e, flowed 264 bbl. of oil in 6 hours on 24/64-in. choke from perforations in the Bromide sand on final production test.

The 4 Nunley in NW NW NW 15-5s-5e, recovered 22 bbl. of oil in 10 hours on a swab test of the third Bromide sand, and from the McLish sand recovered 58 bbl. of oil in 10 hours.

The 4 Griffin in NW NE NE 16-5s-5e, flowed 267 bbl. of oil in 4½ hours from McLish sand at 6,620-30 ft.; the well flowed 84 bbl. of oil in 8 hours from first Bromide sand perforations at 5,792-5,818 ft.

West Chitwood Field Extended in Grady County

Sunray Mid-Continent Oil Co. has completed the 1 Wirt Franklin as a producer in the upper Hoxbar zone of West Chitwood field in Grady County. Location is C SE¼ SW¼ 13-5n-7w.

The well, an extension of West Chitwood field, flowed at the rate of 350 bbl. of oil a day through a ⅜-in. choke with tubing pressure of 175 lb. Gas volume was 182,000 cu. ft. a day and the gas-oil ratio 520:1. The hole started flowing after the pay zone was fraced with 11,000 gal. of oil and 14,000 lb. of sand. Producing depths are 9,760 to 9,770 and total depth of the hole is 10,284 ft.

KANSAS

Simpson Oil Tested at Stafford County Strike

Northeastern Stafford County has a new Simpson oil pool in prospect. The indicated discovery well is Transit Corp. and Monsanto Chemical Corp. 1 Krankenberg in SW SW SE 19-22s-12w, about 2 miles south of Drach pool.

A drill-stem test in the Simpson dolomite at 3,695-3,726 ft. recovered 1,800 ft. of gas and 270 ft. very heavily oil and gas-cut mud.

. . . D. R. Lauck Oil Co. 1 Fergus is a new gas discovery well in southwestern Stafford County.

The operator is waiting for pipeline connection at the wildcat which is in the NW NW SW 23-24s-15w, 1¼ miles north of Farmington pool. The well gaged 1,783 M.c.f. of gas per day on test of the Kinderhook-Mississippian sand at 4,130-50 ft. Acid caused the well to increase its flow to 2,574 M.c.f. per day. The discovery is now shut in.

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Mississippi Discovery Seen in Chautauqua well

Continental Oil Co. has an indicated Mississippian oil discovery at 1 Rich in NE NE NE 16-33s-9e, about 5 miles north of Wauneta pool in Chautauqua Cunty, eastern Kansas.

Recovery on a drill-stem test at 2,292-2,315 ft. was 30 ft. gas and 30 ft. slightly oil-cut mud. Another test at 2,315-45 ft. got 35 ft. slightly oil-cut mud.

PACIFIC COAST

CALIFORNIA

Texaco Hits New South Mountain Pool

The Texas Co. scored a new pool discovery west of South Mountain field in Ventura County. The operator first completed this 7,720-ft. test, 1 Richardson-Earl, early this month but after an initial pumping production of 75 bbl. daily, it quickly tailed off to just 22 bbl. At that point The Texas Co. pulled the tubing and ran a Sandfrac job, January 21. On initial test the well flowed 315 bbl. daily of wash oil through a 24/64-in. choke.

This test is perforated at 7,211-7,720 ft. in a Pico formation in a Pliocene fault trap on the north side of the Oakridge fault. The Texas Co. will further develop the area, located NE SW 14-3n-21w.

New Fault Block Find At Rideout Heights

A possible new fault block discovery was chalked up by Aeco Corp. with 1 Rideout Heights Comm. about 1½ miles west of Whittier field in Los Angeles County. On its first test the well pumped 124 bbl. in 12 hours of clean 20.3°-gravity crude.

Aeco first drilled to 8,574 ft. without getting a commercial producer. The test was then plugged back and redrilled to 1,867 ft. and perforated in the new zone at 1,862-1,614 ft. The discovery is in NW NE 17-2s-11w.

Richfield Abandons First Laubacher Extension Test

Richfield Oil Corp. abandoned 2 Richfield-Doheny-Laubacher - Fleischer, the 12,400-ft. first extension test of its Laubacher pool discovery in Montalvo field, Ventura County. This dry hole was drilled from a site only 50 ft. west of 1 Doheny, the 14,001 ft. discovery well which Richfield completed last July in a Sespe formation at 11,106-34 ft.

Several bad fishing jobs which required two redrillings plagued this first extension. The test was first plugged at 7,290 ft., whipstocked, and redrilled to 7,415 ft. It was again plugged back to 7,176 ft. and redrilled to 12,356 ft.

The Texas Co. Misses at Oxnard

The Texas Co. failed to extend Sespe formation production on the southeast edge of Oxnard field in Ventura County. Texaco drilled 1 Capital-Oxnard through the Topanga volcanics to a total depth of 11,010 ft. but was unable to get a producer in any of the three zones producing below the volcanics in this field. This test was located SE SW 5-1n-21w.

Cuyama Valley Dry Hole

C. W. Colgrove abandoned the 6,164 ft. 84-24 Colgrove 1 mile northeast of Russell Ranch production in Cuyama Valley, San Luis Obispo County. Signal Oil & Gas also tried to extend Russell Ranch production in this same region in 1951. At that time Signal drilled 1 Signal-Harrington to 6,101 ft. before abandoning the project. This test was about ¼ mile southwest of Colgrove's dry hole in SE NE 24-11n-28w.

ARK-LA-TEX

EAST TEXAS

Angelina Wildcat Has Oil Shows

On the basis of successful drill-stem tests, Angelina County was in line for another producing pool, 12 miles southeast of Luakin.

E. L. Kurth Trustee 8 Angelina County Lumber Co., Thomas Caro Survey, recovered 1,230 ft. of 42° oil, and 1,600 ft. of salt water, on a 1-hour and 50-minute test of the Wilcox sand at 3,931-44 ft. Top and bottom chokes were ¼-in.; flowing pressure was not reported. Following the test, drilling continued toward contract depth of 5,500 ft. L. C. Peters Drilling Co., Longview, has contract.

Location of the wildcat is southeast of the old 1-well Kurth-Byars Wilcox discovery. This well was completed in 1952 for a daily production of 87 bbl. of 41° oil through ⅛-in. choke, from pay at 3,938-40 ft.

Sam Trant 1 McKnight, a deep wildcat slated for 10,000 ft., was drilling ahead below 9,743 ft. at last report. Location is in the northern end of Angelina County, 2½ miles north of the town of Pollock, in Joseph Durst Survey, A-201. No shows or tests have been reported.

ARKANSAS

Cotton Valley Drilling On Increase at Smackover

There is a decided increase in Cotton Valley exploration on the flanks of Smackover field's Snow Hill area in southern Ouachita County, south-central Arkansas.

Don H. Peaker and associates 1 Reynolds & Berg in 28-15s-15w, sparked the current play in the area. The well flowed 241 bbl. of oil per day on ¼-in. choke from the Cotton Valley sand at 3,363-67 ft. This well was completed last November. Two more wells have been added to the Cotton Valley production list. There is also a Travis Peak producer.

Gas Discovery Reported In Old Aetna Area

Athletic Mining & Smelting Co. has opened a new gas area in west-central Arkansas at the 1 James Mantooth in C NW NW NE 15-8n-27w, about 7 miles south of Ozark, Franklin County.

The well flowed open 15,000 M.c.f. of gas per day from two zones in the Atoka sand and one in the Hale sand. Production is from 4,630-72 ft. in open hole in the Atoka; and from perforations at 5,348-67 ft. in the Atoka, and 5,605-47 ft. in the Hale. The well flowed 5,500 M.c.f. of gas per day from the Hale. In the lower Atoka zone it flowed 4,000 M.c.f. per day and in the upper sand it made 4,500 M.c.f.

Location staked. Stephens Investment Co. has staked a 6,000-ft. Hale sand test on the south flank of Cecil field in Franklin County. The I Hiatt in 1-8n-29w, is 4,600 ft. south of production at Cecil field. It lies 1¼ miles northeast of Vesta.

WEST TEXAS-NEW MEXICO

SOUTHEAST NEW MEXICO

Continental 4 Bell Lake Scheduled to 17,000 ft.

The San Simon (Bell Lake) field on the northeastern rim of the Delaware basin in southern Lea County, New Mexico, was in line for a fourth test. Continental Oil Co. announced plans for 4 Bell Lake Unit. Location is in SE NW 6-24s-34e. Projected depth is 17,000 ft. Drill site is ½ mile south of the same operator's 1 Bell Lake. Devonian gas-distillate discovery of the field.

Dean-Devonian field . . . This field, 5 miles northeast of Lovington, has enjoyed a rapid development since its discovery by Sinclair and Dan and Jack Auld at 1 Dean, last August. At this report, five wells had been completed in the Devonian.

Recent Dean completions included Sinclair 1-396 State-Lea, north offset to the field discovery. Potential was 1,179 bbl. of 52.8° oil a day, through 44/64-in. choke, from pay at 13,625-13,690 ft.

On the field's east side, Cities Service Oil Co. 1-AW State was completed for 553 bbl. of oil a day through 40/64-in. choke, from open hole at 13,606-13,700 ft.

Atlantic Refining Co. 1 Federal-Dow, a prospective southeast extension, recovered gas and 300 ft. of clean oil while testing at 13,711-13,750 ft. Further testing was scheduled.

ROCKY MOUNTAIN

MONTANA

Carter County Discovery Flows 60 BOPH

Ohio Oil Co. had a flow of oil at the rate of 60 bbl. per hour on initial

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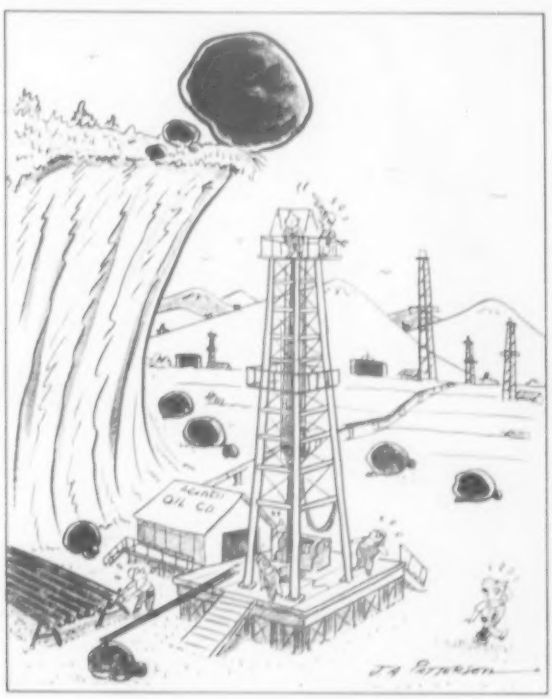

"I don't care how many years it's hung up there—I never was nervous and fidgety on a job before!"

production tests of its discovery in the Repeat area of Carter County.

The well, 1 Government, Clot 6, 4-1s-62e, flowed 169 bbl. oil and 7 bbl. of water in 2 hours, 40 minutes. Test was of the interval 8,605-10 ft. in Red River (Ordovician). Choke size and pressures were not reported. The interval was acidized before test.

The well, 19 miles south of Little Beaver field, Fallon County, was reported a discovery several weeks ago when 4,300 ft. of free oil was recovered on drill-stem test 8,602-20 ft. It was deepened to 9,362 ft. without encouragement in lower formations before plugging back for further test of the Ordovician.

Significant Exploration Planned Throughout State

Widely scattered wildcat locations have been announced through several important Montana areas. Phillips Petroleum Co. has made location for 1 Randall, C NE SE 6-21n-5w, in the Gilman area of Teton County. This well is to test Cambrian at about 7,450 ft. It is between the Sweetgrass arch and the disturbed belt which fronts the mountains through this portion of the state.

In Rosebud County, Richfield Oil Co. will drill a 3,500-ft. test of Otter on the western flank of the Porcupine Dome. The well is 1 Lentz, C NW SE 12-10n-37e. It is the second test in the area, and is 10 miles southeast of a failure drilled last year by Richfield.

In Yellowstone County, Vernon Taylor and Lawrence Barker made location for an Amsden test 1¾ miles south of Carter Oil Co.'s apparent discovery south of Wolf Springs field. The new well is nearly 4 miles south and east of the Wolf Springs discovery.

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NORTH DAKOTA

Ward County Wildcat To Be Abandoned

Calvert Drilling Co. will abandon its Ward County wildcat, 1 O'Clair, NW NW 15-160n-87w, despite early shows which indicated the first discovery in the county. Tests of perforations in the well have recovered only salt water. Last interval tested 5,818-24 ft. swabbed 300 bbl. of salt water per hour after acidization.

The well is 17 miles southeast of Calvert's Coteau field discovery in Burke County. Drill-stem tests of Mission Canyon recovered free oil with very little water.

Meanwhile, Calvert has announced location for additional wells in the North Dakota series being drilled on acreage farmed out by Stanolind Oil & Gas Co. Thirteen wells have been completed or staked in this series. The operators have not disclosed the total number of wells now planned in the series.

UTAH

Coalbed Canyon Wildcat Temporarily Abandoned

Gulf Oil Corp. has temporarily abandoned 1 Coalbed Canyon Unit, C SE SE 15-35s-25e, San Juan County. The well flowed 13,900,000 cu. ft. of gas per day with 120 bbl. of distillate per day on early tests. During later testing gas recovery has declined to almost 2,000 M.c.f. per day. Recoveries were from Paradox.

COLORADO

Shows Recovered at Rio Blanco County Wildcat

Phillips Petroleum Co. recovered 250 ft. of heavily oil and gas-cut mud on test of Weber at 1-A Douglas, E½ NW NE 17-1s-101w, in the North Douglas area of Rio Blanco County. Two tests were run, at 7,505-39 and 7,539-97 ft. with oil and gas-cut mud recovered in each case.

Phillips is coring below 7,680 ft. The well is 15 miles northwest of Hell's Hole Canyon.

GULF COAST

TEXAS GULF COAST

Deeper Pay Indicated in New San Patricio Area

Conroe Drilling Co. and Stanolind Oil & Gas Co. have another indicated discovery well in the new producing area 5 miles northwest of Aransas Pass, in San Patricio County, near the Aransas County line.

Their 1 McDougal and others recovered 270 ft. of gas and condensate-cut mud in an open-hole drill-stem test at 8,755-72 ft. The recovery was through ¼-in. chokes with 1,500 ft. of water cushion. Tester was open 20 minutes, flowing water cushion in 16 minutes. No salt water was indicated. Working pressure was 300 psi.

Location is southeast of a gas-condensate discovery well (2 Bankers Mortgage) completed last December by the same operators in another Frio zone, perforated at 8,454-64 ft.

New Deep Reservoir Opened In Bailey's Prairie Area

New deep gas-condensate production has been discovered in an area west of Bailey's Prairie field, 6 miles west of Angleton, in Brazoria County.

Discovery is by F. A. Callery, Inc., at 1-A Munson, completed in a reservoir perforated at 12,144-48 ft. During completion tests, the well flowed at the rate of 3,005,000 cu. ft. of gas per day through 9/64-in. choke. Condensate yield was at the rate of 9 bbl. per 1,000,000 cu. ft. Flowing pressure was 7,750 psi. Shut-in pressure is 7,900 psi. Gravity of the condensate is 46.3°.

The area is designated as Stone field. The operator's second well, 1 Bartell, 1,980 ft. west of the discovery well, is nearing the pay zone depth.

SOUTH LOUISIANA

Second Producer Confirms Caillou Island Extension

R. W. O'Meara has confirmed his recent good oil-discovery on Timbalier Island, 3 miles southeast of production on the Caillou Island dome, on the coast of Terrebonne Parish.

His second well, 1 Daspit & Belonger, northwest offset to the discovery well, flowed at the rate of 260 bbl. of 32.5°-gravity oil per day through ⅛-in. choke. No water was evident. Flowing pressure gaged 2,500 psi.

Production is from the discovery well's pay with perforations at 10,704-10 ft. The discovery well, 1 L.L.&E., completed last November, is perforated at 10,758-64 ft.

Sparta Discovery Opens Third Melville Pay Zone

Kendall Shaw's new Sparta discovery well in Melville field, St. Landry Parish, flowed at the rate of 130 bbl. of 48°-gravity oil per day through 5/32-in. choke in final completion gage. Flow was with 98,000 cu. ft. of gas under pressure of 1,000 psi. Pay is perforated at 10,364-68 ft. with total depth of 10,422 ft. No water was indicated.

The well, 1 Artall, is the third for the field. Production of the other two wells is from deeper sands, one at 10,983-10,990 ft. and the other at 11,240-45 ft., in Wilcox.

SOUTHWEST TEXAS

Northwest LaSalle County To Get Deep Wildcat Test

Another attempt to explore deep formations along the extension of the Balcones fault trend through Texas' far-southwestern counties will be made in a rank wildcat test to be drilled by Shell Oil Co. in northwestern LaSalle County.

Shell's projected test is scheduled to go to 11,500 ft., which should take it at least to the Edwards lime, one of

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Magnesium anodes are now being used effectively to stop external corrosion on oil and gas well casing. Here's how one major oil company used this low-cost method on 130 wells, 5000 feet deep.

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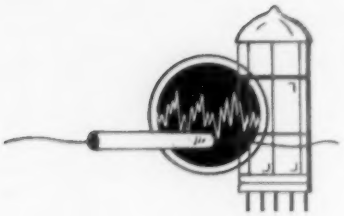

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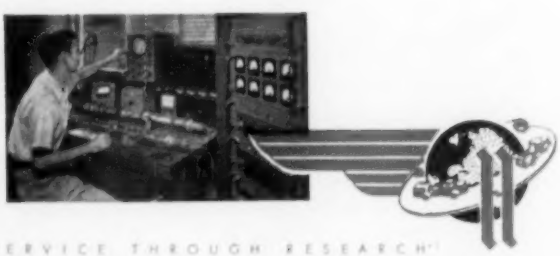

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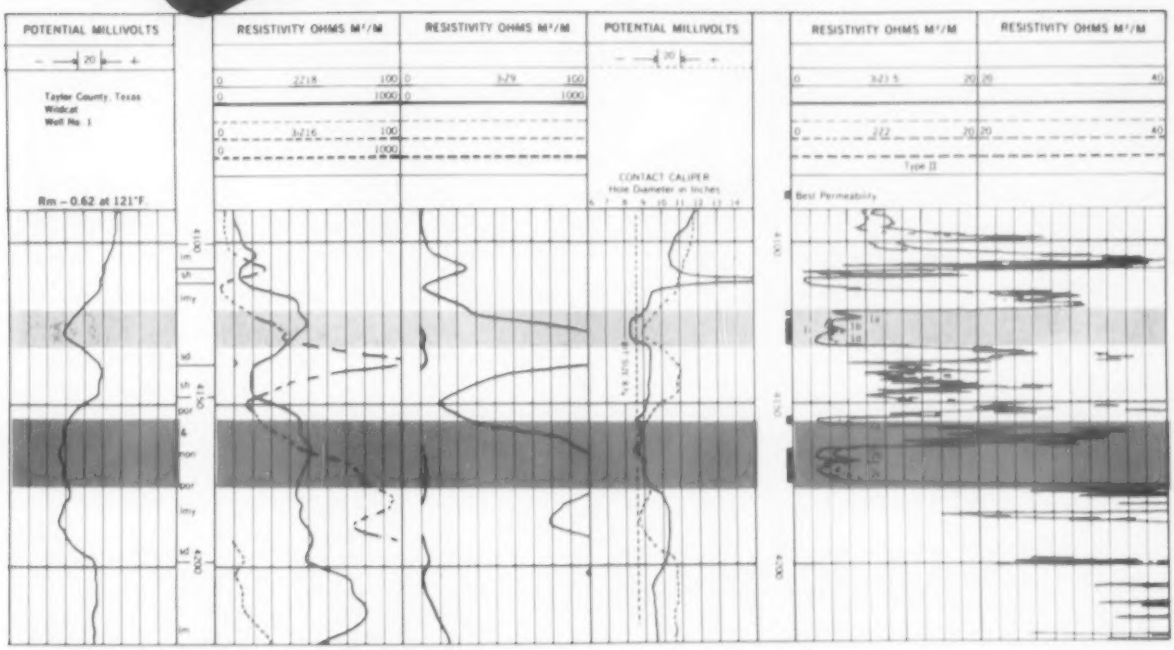

HALLIBURTON LOG ANALYSIS (partial summary)

RM — 0.62 OHM-M at 121°F

	4113'-4138'	4446'-4487'
Formation	Strawn	Strawn
Porosity	19.9%	11%
Water Saturation	10.8%	20%
M. R. H.* (BBLS./ACRE-FOOT)	1150	530

*Maximum recoverable hydrocarbons in place

INITIAL PRODUCTION:
127.4 bbls/day through 14/64 choke

GAS-OIL RATIO: 1890

OIL GRAVITY: 41.6

PERFORATION: 4164' to 4174'

Here is another example of the dependability of well and reservoir evaluation by Halliburton's Electrical Well Services. This log is for a wildcat in Taylor County, Texas. Production data are seen to be thoroughly consistent with reservoir characteristics indicated by the Halliburton Electric Log and Analysis. Log Analysis shows an excellent reservoir up the hole for future production.

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major objectives in this spreading southwestern exploration.

Its location, listed as 1 Mathews, is 11 miles northwest of Cotulla in Block 4 of I&GN Survey 2. It is more than 20 miles from nearest production of any kind.

Jim Wells Discoveries Open Two New Oil Areas

Completion of two oil-discovery wells was reported in Jim Wells County the past week.

One was by Hobby, Rossebo, Battaile & Chiles, 4 miles southwest of Ben Bolt in La Trinidad Grant. This well, 1 Josefa Garcia, flowed 26.81 bbl. of 39°-gravity oil per day, gaged through chokes ranging in size from ⅛ to ⅝-in. Its pay is perforated at 4,978-84 ft. Location is east of production in Ben Bolt field.

The other was in the South Bentonville area, 4½ miles southwest of Agua Dulce, where Skelly Oil Co. 1 Hill flowed 107 bbl. of 42.5°-gravity oil per day through ⅞-in. choke from perforations at 5,772-78 ft. in hole bottomed at 5,884 ft. Location is 732 ft. northwest of a gas producer completed last August.

Successful Wildcats

ALBERTA

Texaco McColl B-6-9 Aurora, LSD 6, 9-49-10w5. TD 5,886 ft. Cardium oil well.

Cal-Standard 8-11 Cynthia SE, LSD 8, 11-49-12w5. TD 7,275 ft. Indicated Cardium oil well.

Cal-Standard 4-12 Cynthia NE, LSD 4, 12-50-12w5. TD 7,070 ft. Indicated Cardium oil well.

ARKANSAS

Franklin County: Athletic Mining & Smelting Co. 1 James Mantooth, C NW NW NE, 4⅝ miles east-northeast of Peterpender, and 7⅞ miles south of Ozark. IP 5,500 M.c.f. of gas per day from Hale at 5,606-47 ft.; 4,000 M.c.f. per day from Atoka at 5,348-67 ft.; and 4,500 M.c.f. per day from Atoka at 4,630-72 ft. TD 5,700 ft. (Discovery well of Aetna field.)

COLORADO

Logan County: Gem Oil, E. K. Bludworth 1 Luft, NE SW SE 5-7n-52w. IP 9,300 M.c.f. of gas per day, "J," sand discovery, new field. TD 4,500 ft. "J" sand.

Weld County: Petroleum, Inc. 1 Eller-Meyer, SW SW SW 2-8n-56w. IP 3,250 M.c.f. of gas per day, "J" sand discovery, new field. TD 5,838 ft. "J" sand.

CALIFORNIA

Fresno County: Los Nietos Co. 38-36 Short, SE SW 36-20s-16e, IPP 1,500 BOPD, 30.4° gravity, perfs. 10,826-10,912, 10,930-11,089 ft., 1-in. choke, 1,000 M.c.f. gas, TD 11,096 ft. (Successful extension test ½ mile north of Polvadero area production in Guijarral Hills field.)

Kern County: Richard S. Rheem 67 Standard, SW SE 27-29e-29e, IPP 75 BOPD, 40° gravity, perfs. 4,590-4,619 ft., 10/64-in. choke, TD 6,119 ft. (New pool discovery on north flank of Racetrack area of Edison field.)

Ventura County: The Texas Co. 1 Richardson-Earl, NE SW 14-3n-21w, IPP 75 BOPD, 31.7° gravity, perfs. 7,211-7,720 ft., 16/64-in. choke, TD 7,720 ft. (New pool discovery in Willard Bridge area of South Mountain field.)

ILLINOIS

Edwards County: Oslager 1 Potter, SW SW NW 4-2s-10e. IPP 62 BOPD, lower O'Hara 3,314-19 ft. TD 3,384 ft. (Opens Albion Central pool.)

KENTUCKY

Muhlenberg County: Welch & Ackenberger 1 Wells, opens Long Creek field. IPP 40 BOPD, 712-29 ft. TD 906 ft.

SOUTH LOUISIANA

Ascension Parish: Monterey Oil Co. 1 Falcon estate, 20-10s-2e. IP 2,820 M.c.f. daily and 56 BCPD, ⅝-in., perforations 10,956-84 ft. TD 11,503 ft. (New pay and extension—northwest flank Darrow dome.)

Cameron Parish: Continental Oil Co. (operator for CATCO group) 1-B State Lease 1656 (OCS 0190), Block 192, West Cameron area, Gulf of Mexico. IP 860 M.c.f. daily, ⅛-in., gas, perforations 5,870-78 ft., and (dual completion) 747 M.c.f. daily, ⅛-in., perforations 4,910-20 ft. TD 13,829 ft. (New pays in West Cameron Block 192 field.)

Lamson, Bennett & Cole 1-J Miami Corp., 11-14s-7e. IP 2,500 M.c.f. daily and 67.5 BCPD, X-6 choke, 46.7°, perforations 9,624-28 ft. TD 10,720 ft. (New field.)

Iberia Parish: Humble Oil & Refining Co. 1 East Bayou Pigeon Oil Unit 1, 35-12s-11e. IP 240 BOPD, ⅛-in., 37.7°, perforations 12,450-55 ft. TD 13,528 ft. (New field.)

Lafourche Parish: Stanolind Oil & Gas Co. 1 Petit, 5-18s-21e. IP 1,980 M.c.f. daily and 45 BCPD, ⅛-in., perforations 11,658-72 ft. TD 11,777 ft. (New pay and outpost in Bully Camp field.)

SOUTHEAST NEW MEXICO

Eddy County: Ohio Oil Co. 1-A Johnson-Federal, 10-18s-31e, IPP 91 BOPD, plus 96 BSW, GOR 227, 32.8°, top Grayburg pay 3,957 ft., TD 4,785 ft.

Lea County: Humble Oil & Refining Co. 1 New Mexico "AR," 36-15s-34e, N of Townsend-Wolfcamp field. IP 454 BOPD, ⅜-in., TP 400, 44°, GOR 1660, Pennsylvanian pay 10,820 ft. TD 13,433 ft., elev 4,046 ft.

Sinclair Oil & Gas Co. 1 State "735," 26-15s-36e, N extension to Dean field. IP 792 BOPD, ½-in., TP 450 psi., GOR 1577, 42°, Pennsylvanian 11,560-11,600 ft. TD 13,868 ft., elev. 3,876 ft.

Roosevelt County: Shell Oil Co. 2 Bluit, 16-8s-37e. Dry, TD 12,595 ft. Elev. 4,042 ft., Mississippian 11,500 ft., Woodford 11,610 ft., Devonian 11,730 ft., Montoya 12,030 ft., Simpson 12,110 ft., Ellenburger 12,120 ft., pre-Cambian 12,540 ft.

SOUTHWEST TEXAS

Atascosa County: RAR Special 1 Wyvlecka, J. Poitevant Sur., IPP 41.02 BOPD, 19.3°, perforations 1,409-15 ft. TD 1,567 ft. (New field.)

WEST TEXAS

Cochran County: Jake Hamon and Texas Pacific 1-B Thompson, 12-Z-PSL, 12 miles NE Bronco. IP 342 BOPD, 10/64-in., TP 820 psi., GOR 742, 43.5°, Devonian 11,889-94 ft. TD 11,894 ft., top Devonian 11,895 ft., pay 11,889 ft., elev. 3,917 ft.

Sutton County: El Paso Natural Gas 1 Meckel, 125-A-HE&WT, 7 miles NW Sonora. IP calculated open flow 690 M.c.f. gas, Canyon sand 5,556-5,780 ft. TD 6,040 ft.

Tom Green County: Monterey Oil Co. 1 Edwards, Sec. 156, Dist. 11, SPRR, 12 miles SE San Angelo. IP calculated open flow 1,510 M.c.f. gas, pay 4,334 ft. TD 5,297 ft.

Ward County: Gulf Oil Corp. 283 Hutchings Stock Association, 81-N-G&MMB&A, HSA field, new pay discovery, and NW extension. IP 166 BOPD, 25/64-in., TP 190 psi., GOR 2247, 37°, perforated 2,390-2,520 ft.

TEXAS GULF COAST

Orange County: MPS Production Co. 1 Shannon, J. Harman Sur. IP 56.82 BOPD (net), ⅛-in., 41.6°, 20 per cent water, perforations 8,084-87 ft. and 8,093-96 ft. TD 8,630 ft. (New field—reentered hole drilled by Edwin L. Cox.)

NORTH TEXAS

Archer County: Bridwell Oil Co. 2 Koetter, 66-2-Clark & Plumb, 3 miles SSE Windthorst. IPP 49.5 BOPD, 40°, GOR 350, pay 4,424 ft. TD 5,218 ft.

W. L. Lindemann 1 Meurer, Lot 102, Blk. 4, Clark & Plumb, 2 miles NW Windthorst, IPP 25 BOPD, 39°, pay 1,131-43 ft. TD 1,214 ft.

J. C. Mann, Jr. 1-D Schroeder, Sec. 55, Clark & Plumb, Blk. 4, IPP 15.76 BOPD, 42°, GOR 300, Strawn 3,623-28 ft. TD 5,040 ft.

Baylor County: Bridwell Oil Co. 1 Grinke, Sec. 19, Halsell Subd. 1,-1 mile NE Halsell. IPP 83 BOPD, 41°, GOR 530, pay 5,852-66 ft. TD 6,089 ft.

Grayson County: Nortex Oil & Gas Corp. 1 Shannon, Asa Hartsfield Sur., A-491, 2 miles SE Whitesboro. IPP 147 BOPD, 28.6°, GOR 300, pay 4,582-92 ft. TD 4,652 ft.

Montague County: Mendota Oil and Standard Oil of Texas 1 Jones, Lge. 11, A-121, Calhoun CSL, 6 miles SW St. Jo. IP 216 BOPD, 35°, ¼-in., TP 400 psi., pay 6,804-14 ft. TD 6,986 ft.

Young County: Sam Boren 1 Scruggs, TE&L Sur. 1942, 2 miles SW Loving, new pay discovery in Boren-Caddo field. IP 94 BOPD, ¼-in., TP 120 psi., 42°, GOR 300, perforated 2,938-46 ft. TD 4,240 ft. Kenneth Rich & Wesley Stephens 2-A Johnson, TTRR Sur., A-1547, 15 miles SE Graham. IP 152 BOPD, 42°, TP 200 psi., GOR 800, Caddo lime 4,048-56 ft. TD 4,900 ft.

WEST CENTRAL TEXAS

Callahan County: W. D. Evans 1 Dugan, Sec. 72, BBB&C Sur., 4 miles N Clyde. IPP 25 BOPD, 38°, GOR zero, sand 1,666-69 ft. TD 1,663 ft.

Coleman County: J. B. Schick Drilling Co. and Frank Pethybridge 1 Morris estate, Blk. 2, D. B. Austin Sur., 6 miles NE Silver Valley. IP 238 BOPD, 18/64-in., 40°, TP 110 psi., GOR 750, Capps lime 2,506-16 ft. TD 2,940 ft.

Fisher County: Urice Drilling Co. 1 Norris Green, 263-3-H&TC, 2½ miles N Gannon. IP 52.8 BO in 8 hours, ¼-in., TP 200 psi., GOR 800, 43°, Canyon reef 6,023-28 ft. TD 6,604 ft., top pay 5,971 ft., ground elev. 2,117 ft.

Palo Pinto County: R. H. Gogle 1 Weldon, Constantin Sur., A-139, 10 miles E Graford. IP 190 BOPD, ⅛-in., TP 500 psi., GOR 700, 37°, sand 4,060 ft., TD 4,072 ft.

WYOMING

Fremont County: Sohio Petroleum Co. 1 Government-Downing, SW SE SE 26-32n-95w. IP 1,998 M.c.f. of gas per day, Muddy discovery, new pay. TD 9,018 ft. Alcova.

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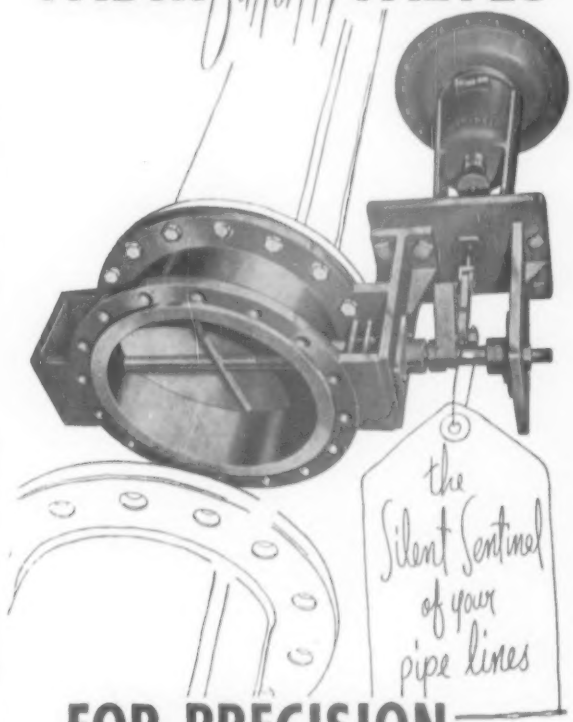

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Inspired by his dad's drilling . . .

. . . Conoco Official Started Early

ORVILLE L. FISHER was a lad of about 14 when he decided on a career in the oil industry. The decision was inspired by his father, W. A. Fisher, an early day Oklahoma drilling contractor.

Young Fisher used to watch his father make hole with an overhauled water-well rig, the type used to drill many of the first oil wells in the Cushing field. By observing his father the youngster learned what he could about dressing tools. Before finishing high school he got a summer job as roustabout for the old Tidal Oil Co.

Now, more than 30 years later, Orville L. Fisher is a vice president of Continental Oil Co. He was elected January 18, but his father didn't get to hear the good news. The elder Fisher died just a week earlier.

Early background . . . The 51-year-old executive was born at Tishomingo, Okla. He was 10 years old when his family moved to Drumright, Okla., which then was passing through its boom-town days.

Soon after finishing high school at Drumright he worked as a tool dresser for several drilling contractors in that area. Then came brief jobs with Tidal and later with Pure Oil Co. In August 1926, at the age of 22, Fisher went to Borger, Tex., as a tool dresser for Marland Oil Co., now Continental.

During his 2 years at Borger he decided he ought to get a little more education. He wanted to be an engineer, but he hated to give up a tool dresser's pay for $100 a month. That's about all he could expect as a petroleum engineer.

"Of course, in those days," recalls Fisher, "That lure of $12 or $13 a day they paid tool dressers kept a lot of kids from going to college."

Young Fisher compromised by taking a correspondence course in engineering. In the meantime, he worked his way through several jobs—tool dresser, foreman, gang pusher, and clerk.

Promotions . . . In 1929, Fisher transferred to McCamey in West Texas as farm boss in production, and he's been in the producing or administrative end of the business ever since.

In the early 30's he was farm boss and later foreman for Group One Oil Corp., a Marland subsidiary which at that time was developing the world's deepest oil production in Big Lake field, Reagan County. The depth was 8,500 ft.

Other promotions soon followed. In 1935, Fisher went to Basile, La., as district production superintendent. Going to Houston in 1941, he moved up from assistant division production superintendent to general superintendent and regional manager in production. In 1949 he moved to the home office at Ponca City, Okla., as assistant production manager, and he returned to Houston the following year as assistant regional manager. Fisher was promoted to regional general manager in 1952.

As vice president he will continue to make his headquarters in Houston and to manage all departments in Conoco's southern region, which embraces about half of Texas, all of Louisiana, parts of Mississippi and Alabama, and the offshore area.

Off duty . . . Fisher's favorite hobby is quail hunting.

"I keep some old dogs the year around just to get to hunt a few days in December," he says. He and a friend have held a hunting lease near Luling, Tex., for a number of years. During off-season, they encourage propagation of wildlife by turning loose small birds and setting out feeders.

A luke-warm baseball fan, Fisher has on his desk a souvenir baseball autographed by the pennant-winning New York Giants of 1954. The ball was given to him by an old friend, Alvin Dark, club captain whom Fisher remembers as "a Lake Charles boy."

Fisher's wife is the former Helen L. Kennedy of Cleveland, Okla. They were married in 1924 when he was working at nearby Drumright.

A modest, almost shy man, Fisher has a more or less standard reply to fellow workers who have been calling to extend congratulations on his promotion. "If the executive committee and the board could pull a bonehead like that," he says, "that should enable me to make a few without too much criticism."

Personals

J. W. Alliston and **J. E. Lawson** have been promoted by Humble Oil & Refining Co. to senior chemical engineers in the Baytown, Tex., refinery's technical service division.

H. W. Earhart has been promoted to research chemical engineer in the research and development division of Humble Oil & Refining Co.'s Baytown, Tex., refinery.

R. G. Bryan, former district petroleum engineer in New Orleans for Union Producing Co., has been promoted to assistant district manager of United Gas Pipe Line Co. Both firms are subsidiaries of United Gas Corp. Bryan also has been field drilling and production superintendent for the producing company in New Orleans and Houma, La.

William S. McCabe, Casper, Wyo., consulting geologist, has joined his brother, **Dr. Louis C. McCabe,** and **Frederick S. Mallette** in forming Resources Research, Inc., research and engineering consultants. He was division geologist and Rocky Mountain division exploration superintendent for Stanolind Oil & Gas Co. before becoming a consultant.

R. M. Churchwell, assistant chief petroleum engineer for Ohio Oil Co., has been promoted to assistant to the president. He succeeds **Grant H. Young,** named to head the newly formed mar-

CHURCHWELL

FOOTE

keting development division. **L. P. Foote,** senior petroleum engineer, takes Churchwell's post. Churchwell joined Ohio in 1941 and has served as division petroleum engineer in Casper, Wyo. Foote joined the firm in 1935 as a roustabout and has been active since in both the refining and production departments.

Personals

Morris Forgash, New York freight executive, has been elected a director of Reiter-Foster Oil Corp., New York.

Clyde W. Winter, Stanolind Oil Purchasing Co. crude buyer, has been transferred from Midland, Tex., to Wichita to head the Kansas district. **James E. Damewood** replaces Winter at Midland as assistant in the West Texas-New Mexico area.

Rudolf Smutny, New York investment banker, has been elected a director of Associated Oil & Gas Co., Houston.

John Wilbor has been named supply and distribution manager of Socony Mobil Oil Co., Inc.'s, central region, comprising 16 states. **Arthur C. Nelson** succeeds Wilbor as manager of the Chicago division.

John W. Kirstein, superintendent of gathering lines for Natural Gas Pipeline Co. of America at Fritch, Tex., has been promoted to field superintendent for pipelines. He succeeds Edward D. Warren, who died recently. Kirstein joined N.G.P.L. in 1940 as a pipeline engineer. He became assistant field superintendent of pipelines in 1951, and was named to his recent post in 1954.

L. G. CHOMBART

Louis G. Chombart has resigned as engineer for Amstutz & Yates, Inc., Wichita, to become a well-log consultant there. At the end of February he will start his first major assignment, a 4-month advisory stint with the Institut Francais du Petrole, Paris. Before joining Amstutz & Yates 5 years ago, Chombart was with Dr. R. G. Hamilton, Tulsa. Earlier, he served 14 years with Schlumberger Well Surveying Corp.

Robert J. Blackwell has been transferred by Humble Oil & Refining Co. from petroleum engineer at Houston to research engineer in the research division there. Other Humble changes: **Robert A. Estes,** promoted from senior supervising civil engineer in Houston to assistant division civil engineer, western division; **Gene W. Huff,** petroleum engineer, moved from the Southwest Texas division office to Houston; and **C. G. Killian,** civil engineer, transferred from the Southwest Texas division to Houston.

R. L. GRAY

Ralph L. Gray has been named division production superintendent in Artesia, N. M., for Buffalo Oil Co. In other Buffalo changes **Neal A. Taylor** has been made superintendent of a newly created production district, headquartered in Midland, Tex.; **Max E. Curry** will head a new production district for New Mexico; and **Glenn Howard** is being transferred from Artesia to Midland as district clerk.

M. E. CURRY

N. A. TAYLOR

Reo E. Goodwin has resigned as West Texas district geologist for Seaboard Oil Co. at Midland, Tex., to become an independent operator and consultant there with **John A. Barnett, Jr.** Goodwin is replaced by **Ben F. Hoffacker, Jr.,** former West Central Texas district geologist at Abilene, Tex.

Douglass R. Keenan, Jr., has resigned as senior geologist in Sinclair Oil & Gas Co.'s Gulf Coast division to join Gulf Coast Leaseholds, Inc., as exploitation geologist.

Homer O. Woodruff has been promoted from assistant manager of The Texas Co.'s Pacific Coast division to assistant general manager of the producing department in Houston. He is succeeded by **Thomas W. Bell,** now division petroleum engineer. The changes are effective February 1. Both Woodruff and Bell joined Texaco as roustabouts, Woodruff in 1933 and Bell in 1934.

John S. Pfarr, a vice president and director of Leonard Refineries, Inc., has been named administrative head of manufacturing, research and development, engineering, and petrochemicals. Pfarr's staff will operate the Leonard, Mid-West, and Roosevelt refining divisions. Named refinery managers were **T. J. Williams,** Roosevelt; **Everett Thompson,** Mid-West; and **Robert Pollard,** Leonard. Williams also was elected a director of Leonard Refineries, Inc.

Edgar Whitehead, Jr., has been advanced by Continental Oil Co. from district engineer at Ponca City, Okla., to production foreman in Oklahoma City.

S. C. Naifeh has been promoted by Phillips Chemical Co. from maintenance and mechanical superintendent at Borger, Tex., to services superintendent at Pasadena, Tex.

Aaron Cawley has resigned as reservoir engineer with Forest Oil Corp. at Midland, Tex., to join Keller & Peterson, Fort Worth consultants.

H. C. Slider has resigned as Illinois division reservoir engineer for Shell Oil Co. to become associate professor of mining and petroleum engineering at Ohio State University.

B. W. Blanpied has been moved up by Gulf Oil Corp. from zone exploration manager to division staff geologist at Shreveport. **J. L. Herndon,** former zone landman, succeeds Blanpied.

George F. Brigance, who retired recently as chief engineer of Socony Mobil Oil Co., Inc.'s eastern pipelines, has become a consultant at Plainfield, N. J.

Frank C. Ware, regional sales manager of Ashland Oil & Refining Co. since 1951, has been named executive vice president of Aetna Oil Co., refining and marketing subsidiary. He succeeds **Dr. Clive M. Alexander,** who retired recently after 25 years with Aetna. Ware joined Ashland in 1934 and was Louisville division sales manager from 1949 to 1951.

Roger J. Bassett, district geologist for Pan American Production Co., in Shreveport, will resign February 15 to join J. C. Mayfield, Shreveport independent.

P. D. BARTON

Paul D. Barton, chief engineer of Sun Oil Co.'s manufacturing department since 1947, has been named director of engineering. **George M. Closs,** recent manager of Sun's Toledo refinery, becomes associate director. In other changes, **John F. Harron,** superintendent at Toledo since 1943, succeeds Closs, and **Herbert C. Thober** moves up from operating assistant in the distillates and cracking division to superintendent.

Chester L. Wheless and **Pierre M. Aubuchon** have resigned from La Gloria Oil & Gas Co., Corpus Christi, to open offices in Austin as Wheless & Aubuchon, consultants. Wheless, who was La Gloria's chief petroleum engineer, joined that firm 15 years ago. Aubuchon, a petroleum engineer for La Gloria, earlier had been district reservoir engineer for The Texas Co. The new firm will specialize in evaluation, management, proration, and unitization of oil and gas properties.

C. L. WHELESS

P. M. AUBUCHON

Ray R. Irwin, northwest central area manager of refineries, pipelines, and supplies for Socony Mobil Oil Co., Inc., has retired after 37 years with the firm and predecessors. Irwin, active in the industry for 46 years, was president of White Eagle Oil Corp. before its acquisition by Socony. He is a former director of Western Petroleum Refiners Association, and has served on a number of government-industry committees since World War I.

Rodman Jenkins, senior research engineer for Magnolia Petroleum Co. at Dallas, has been transferred to Socony Mobil Oil Co., Inc.'s, Paulsboro, N. J., refinery.

George Y. McCoy and **J. Randolph Buck,** Dallas consulting engineers, have joined in a new firm to specialize in analysis of oil and gas reserves, valuation reports, and secondary-recovery studies. Buck, former senior production research engineer for Magnolia Petroleum Co., has been a consultant 3 years. McCoy, an independent for 8 years, had been with Republic National Bank, Dallas.

James R. Shipley, former Sohio Pipe Line Co. chief engineer, has been named to head the administrative section. **Charles E. Curry,** now general superintendent, takes Shipley's post. **Henry W. Pattison,** who has headed the administrative section, becomes general superintendent. All three are vice presidents and directors of the Pipe Line Co., a subsidiary of Standard Oil Co. (Ohio). Shipley returned recently from leave of absence in Europe, where he was chief of NATO's P.O.L. section.

George M. Good has been promoted by Shell Development Co. from research supervisor at Emeryville, Calif., to assistant to the president in New York.

Malcolm C. Gillis has been moved up by Stanolind Oil & Gas Co. from petroleum engineer in Oklahoma City to field engineer at Ulysses, Kans.

G. Jordan Petsoff, assistant district geophysicist of Forest Oil Corp. at Denver since last July, has been advanced to district geophysicist. He succeeds **R. L. Schmidt,** who resigned recently.

Guy Willis has resigned as crude-oil representative for Pan American Production Co., Midland, Tex., to join McWood Corp., Abilene, Tex., as general manager. **Oren Cloud,** who has headed the crude department's division order section for Pan American at Houston, replaces Willis.

Frank J. Karmelich, former geologist and petroleum engineer for Westates Petroleum Corp., has joined Sunset Oil Co., Los Angeles.

Dr. Raymond Cecil Moore, of the University of Kansas geology department, has been elected an honorary member of the Society of Economic Paleontologists. Moore, state geologist of Kansas from 1916 to 1954, is one of the three living S.E.P.M. members to be so honored.

Personals

C. Donald Attaway has been named works manager of Gulf Natural Gas Corp.'s gasoline extraction plant, Oil City, La.

John S. Rearick, manager of engineering for C. W. Notsinger Co., has been elected vice president. Rearick joined the Kansas City, Mo., engineering firm in 1954 after 16 years with M. W. Kellogg Co., where he specialized in development of refining and chemical processes.

J. W. Collier, gas engineer in Pure Oil Co.'s southwestern producing division, Tulsa, will be promoted to assistant division gas superintendent in Fort Worth effective February 15. Other Pure changes are: **O. L. Gambrell,** transferred to Tulsa as assistant division gas superintendent; and **W. J. Henry,** promoted to district geologist at Wichita Falls to replace **R. C. Choens,** who recently resigned.

Samuel Kahn and **Dr. W. J. G. Cudmore** have been promoted in the research department of Standard Oil Co. (Ind.). Kahn, who joined the firm in 1954 as a patent researcher, becomes patent advisor in the Whiting, Ind., research section. Cudmore, a chemical engineer with Indiana Standard since 1953, now is group leader at the Mandan, N. D., laboratory.

Los Angeles Nomads Name New Officers

Harry E. Hester, McCullough Tool Co., was elected president of the Los Angeles chapter of Nomads at its recent annual business meeting. Officers chosen for 1956 and outgoing officers are, seated left to right: Leo Cypher, Baash-Ross Tool Co., 1955 treasurer; James D. Hughes, Lane-Wells Co., 1955 regent; H. J. Schlarb, Emsco Manufacturing Co., 1955 president and 1956 regent; Hester (1955 vice president); and Tom G. Martin, of R. J. Eiche & Associates, 1956 vice president. Standing, left to right, are: J. Murray Walker, Lane-Wells Co., 1956 deputy sergeant-at-arms; Wallace A. Sawdon, executive secretary; John S. Page, Page Oil Tools, 1956 assistant treasurer; H. Rex Collins, Jr., Hydrill Co., 1956 treasurer and 1955 deputy sergeant-at-arms; John McEwen, Stansbury, Inc., 1956 assistant treasurer; Earle Atkins, consultant, 1955 secretary; Harry M. Taylor, Bettis Rubber Co., 1955 assistant treasurer; Knight Templeton, of S. R. Bowen Co., 1955 assistant secretary; and Robert P. Gaylord, Wagner-Morehouse, Inc., 1956 secretary and 1955 sergeant-at-arms. Not shown: John Flanagan, Johnson Testers, Inc., 1955 and 1956 regent; and William C. Brooks, Byron Jackson Co., 1956 sergeant-at-arms.

Personals

H. A. W. Kidd, assistant to the director of Socony Mobil Oil Co., Inc.'s New York laboratories for 3 years, has returned to Dallas as assistant to Magnolia Petroleum Corp.'s natural gas department manager.

J. T. HIGGINS

J. T. Higgins, former president of Salt Lake Refining Co. and Salt Lake Pipe Line Co., has been named general manager of operations in Standard Oil Co. of California's manufacturing department. He succeeds **Francis H. Smith,** who has retired after 43 years' service. Higgins, who joined Socal in 1929, served as a specialist at the El Segundo, Calif., refinery until 1937, when he began a series of supervisory assignments at Richmond, Calif., and San Francisco. Before heading the Salt Lake City subsidiaries, he was operations manager at Richmond. Smith, who joined Socal in 1913 as a blueprint boy, had been operations manager since 1945.

D. W. Ross has been transferred by Texas Petroleum Co. from Colombia to Venezuela as assistant manager. In other changes **R. C. Newman,** petroleum engineer, moves from The Texas Co.'s South Texas division to Texpet's Venezuelan division, and **G. D. Furlow** has joined Texpet in Colombia as petroleum engineer.

Lester J. Ringerberg has resigned as exploration vice president of Smith Petroleum Co., Grand Rapids, Mich., to join Lion Oil Co. as head of the Salt Lake City geological department.

Glen F. Nelson, Pioneer Oil Co., Fargo, N. D., has been elected president of Northwest Petroleum Association. Other new officers: **John Kuether,** Mille Lacs Oil Co., Milaca, Minn., vice president, and **N. R. Distel,** Distel Oil Co., Le Sueur, Minn., treasurer. **H. F. Horning,** Minneapolis, continues as executive secretary.

W. T. Shirley, Sinclair Crude Oil Co., Midland, Tex., has been named president of Permian Basin Crude Oil Representatives Association. Other new officers: **J. C. Hart,** Shell Oil Co., vice president; **Joe R. Lennon,** Magnolia Petroleum Co., secretary-editor; and **John A. Mills,** The Texas Co., treasurer.

Alvin F. (Al) Smith has resigned as resident engineer with McMurrey Refining Corp., Tyler, Tex., to join Procon, Inc., as project engineer at Des Plaines, Ill.

Edward L. Karn, Jr., has resigned as division engineer with Pacific Western Oil Co. to join **E. A. Polumbus, Jr.,** Denver consultant, as a petroleum engineer.

Louis L. Seiffert, Jr., recently secretary-treasurer of Union Texas Co., Houston, has been elected president. He succeeds **S. Rufus Casey, Jr.** Before joining Union Texas, Seiffert was a partner in Petroleum Management Co.

John B. Smith, field drilling and production superintendent for Union Producing Co. at Shreveport, has been moved up to district production superintendent.

Dr. John E. Wood has been moved up by Esso Standard Oil Co. from assistant general manager of the chemical products department, Baton Rouge. He succeeds **O. V. Tracy,** who has resigned but will remain a director of Esso and president of the subsidiary Enjay Co., Inc.

G. L. Brennan, vice president of Warren Petroleum Corp.'s L.P.G. division since 1954, has been elected a director. He replaces **Howard E. Felt,** who resigned recently. Brennan joined Warren in 1941 as manager of the L.P.G. division after 12 years' experience in that phase of the industry.

Robert W. Wiese, recently inspection and corrosion engineer with Western Australia Petroleum Pty., General Petroleum Corp. affiliate, has been promoted to job engineer in General's Torrance, Calif., refinery.

R. M. Leibrock, of Leibrock & Landreth, Midland, Tex., has been named 1956 chairman of the Permian Basin section, American Institute of Mining, Metallurgical and Petroleum Engineers. Others elected: **W. L. Crothers,** Humble Oil & Refining Co., and **M. W. Russell,** Dowell, Incorporated, vice chairmen; and **R. M. Hippard,** Shell Oil Co., secretary-treasurer.

H. J. Ogorzaly, assistant director of Esso Research & Engineering Co.'s petroleum development division, has been named to study nuclear activities affecting chemical and petroleum processes and products quality. **Edward J. Gornowski** has been named a director of the division.

Harold T. Frost, Jr., has been advanced by Atlantic Refining Co. from assistant district engineer at Lafayette, La., to district engineer at Houston.

Ilya A. Mamantov has resigned as seismic party chief for Donnally Geophysical Co. to join Sun Oil Co. as research subsurface geologist in Dallas.

J. W. Stoker, district superintendent for Sinclair Oil & Gas Co. at Carmi, Ill., has been transferred to Seminole, Okla. **C. H. Richards** moves from assistant superintendent at Norman, Okla., to replace Stoker.

DEATHS

Errett Dunlap, 74, Oklahoma independent producer for nearly a half century, died February 1 in his Ardmore, Okla., office. Dunlap was associated with Jake Hamon and Sam Apple in the early-day Healdton field activity.

J. E. Devine, 71, retired pioneer gas engineer, died January 22 in Mount Pleasant, Mich. Devine entered the industry in 1903 with Hope Natural Gas Co. He was Oklahoma Natural Gas Co.'s chief engineer from 1905 to 1917, and later worked for Peoples Natural Gas Co., Natural Gas Co. of New Mexico, and Wittmer Oil & Gas Co. He retired in September as owner of Michigan Map Service, Mount Pleasant, Mich.

Neil Jackson Norris, Sr., 74, who retired in 1945 as vice president of Bell & Loffland Co., Los Angeles, died there January 24.

Harold M. Cosgrove, 72, executive secretary of the Purchasing Agents Association of Tulsa since 1926, died January 31 in Tulsa. Cosgrove, who also edited the Mid-Continent Purchaser, was widely known in the Oklahoma industry. He was a member of the Tulsa chapter of Nomads.

Harold B. Bernard, 62, who retired in 1935 after becoming a vice president of Sinclair Oil & Gas Co. at 30, died January 29 in his Tulsa home. Bernard specialized in building and operating gasoline plants for Sinclair.

Marshall L. Hough, 56, president of Darling Valve & Manufacturing Co., Williamsport, Pa., died recently of a cerebral hemorrhage in Williamsport.

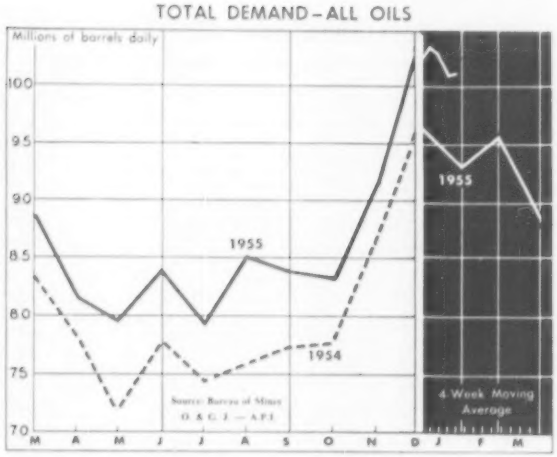
Del Howard, Dallas consultant and former gas engineer, died January 27 in Dallas.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,982,975	DOWN	48,550	UP	173,086
Crude stocks	258,864,000	DOWN	324,000	UP	1,159,000
Completions	1,185	UP	3	UP	217
Refinery runs	8,057,000	UP	105,000	UP	655,000
Gasoline stocks	178,947,000	UP	3,162,000	UP	9,335,000
Kerosine stocks	21,592,000	DOWN	4,974,000	DOWN	2,940,000
Distillate stocks	89,161,000	DOWN	5,449,000	UP	129,000
Residual stocks	38,351,000	DOWN	661,000	DOWN	10,186,000
Four-product stocks	328,051,000	DOWN	4,067,000	DOWN	3,662,000
Total imports	1,414,200	UP	147,700	DOWN	131,000

TOTAL DEMAND—ALL OILS



Group 3 Kerosine and Distillate Prices Rise 0.25 Cent a Gallon

DISTILLATE and kerosine prices moved up 0.25 cent on the Group 3 market at the end of January under the influence of high demand in the northern part of District 2. The low for No. 2 fuel now stands at 9.25 cents a gallon compared with 8.875 cents at this time last year.

Stocks of kerosine and distillate fuels in District 2 are down about 4,000,000 bbl. or 11 per cent from a year ago. At the end of October, District 2 inventories of kerosine and distillates exceeded previous year's stocks by a little more than 4,000,000 bbl. This means that withdrawals from storage in District 2 this winter have been about 8,000,000 bbl. more than last year. This increase in volume taken from storage represents about 14 per cent of total middle-distillate inventories reported for the district at the end of October.

High demand for home-heating fuels in the North Central states has been due both to the gain in number of oil burners in use and to colder weather. To the end of January, the weather had been almost 9 per cent colder than last year.

Another factor in the tight supply situation in the upper part of District 2 has been the decrease in movement of distillates up the Mississippi River. River shipments to District 2 from Texas, Louisiana, and Arkansas totaled about 500,000 bbl. less in November and December than in the same periods a year earlier.

Unless the weather is unusually cold for the remainder of February, kerosine and distillate prices on the Group 3 market probably have reached the peak for the season. Secondary suppliers start cutting back on working inventories of distillates by the first of March with more attention given to gasoline.

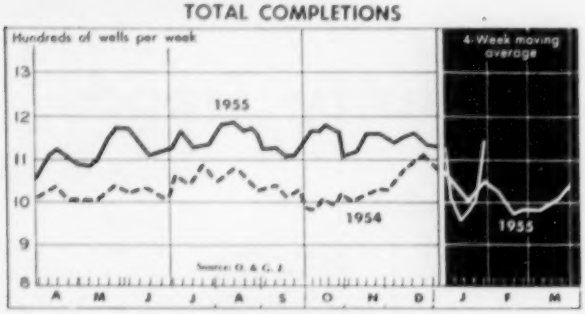
Rail rates increase . . . Rail freight rates are scheduled to increase 7 per cent near the end of this month. On some shipments out of the Mid-Continent, the increase will amount to as much as 0.25 cent a gallon. For the tank-car shipper in the Mid-Continent, this means either the absorption of the increases in shipping cost or a shrinkage of the area to which he can ship competitively. Absorption of the freight increase would take about all of the gain from the latest price increase.

Lube markets are firmer . . . Demand for lube oils is creating stronger markets. If the trend continues, prices for most of the important grades will move up before the end of the first quarter. Some adjustment has been made for certain grades in the Mid-Continent and in the Pennsylvania Grade areas.

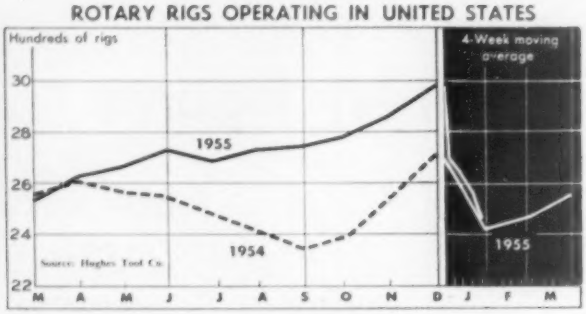
Domestic demand for lube oils averaged about 112,000 bbl. daily for 1955 compared with 105,000 bbl. daily in 1954.

Gulf-East Coast tanker rates have been listed at about 75 per cent above the Maritime Commission base rate for the past 2 weeks. This means a cost of about 1.58 cents per gallon for moving No. 2 distillate compared with a difference of 1.35 cents between cargo quotations on the gulf and barge prices in New York Harbor.

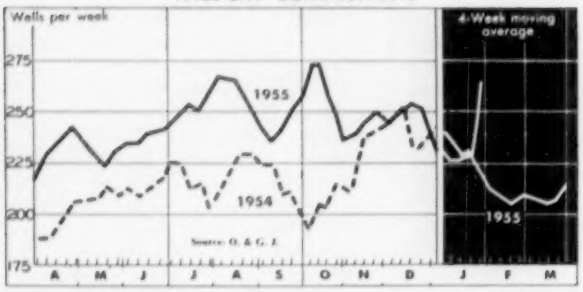
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	1-30-56	Change from 1-23-56	Change from 1-31-55
Gulf Coast	608	—40	83
N. and W. Texas-New Mexico	839	—20	47
Arkansas-N. Louisiana-E. Texas	146	— 9	—16
Oklahoma	269	—15	—33
Kansas-S. Nebraska	175	— 6	— 5
Illinois-Eastern	96	2	—35
Rocky Mountain	193	—13	— 7
Pacific Coast	130		—15
Total United States	2,456	—101	19
Western Canada	211	—11	18

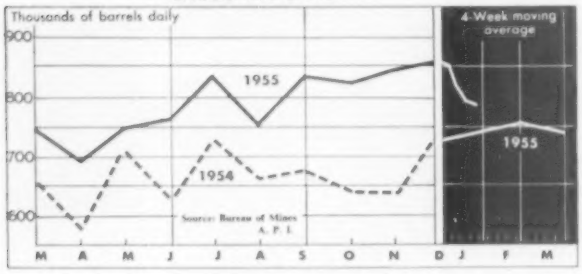
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 28, 1956

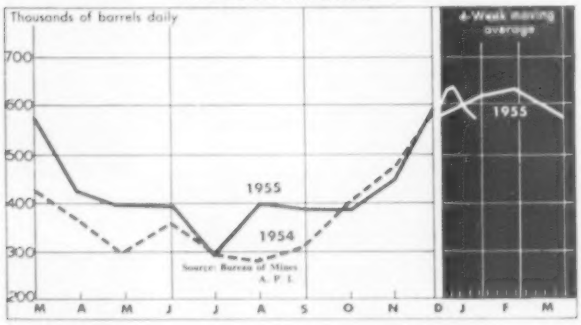
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1956	Cum. 1955	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1956: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	1	0	1	23,675	8	12	0	0	0	0	0	0	0	0	3	3
Arkansas	14	8	0	6	44,131	56	37	2	0	0	3	5	3	0	0	10	13
California	38	27	0	11	202,727	156	135	3	0	0	6	9	3	0	0	24	27
Colorado	29	6	4	19	156,569	99	106	0	0	2	15	17	0	0	3	49	52
Illinois	83	37	1	45	195,021	356	337	1	0	0	13	14	6	0	0	53	59
Indiana	19	7	0	12	35,690	55	50	0	0	0	3	3	2	0	0	12	14
Kansas	77	39	6	32	275,838	332	390	0	0	1	13	14	5	1	2	73	81
Kentucky	41	17	3	21	51,590	162	108	1	0	0	8	9	4	0	0	38	42
Louisiana	77	44	6	27	622,471	368	325	2	3	1	12	18	5	10	2	52	69
North	28	20	2	6	112,342	154	185	0	0	0	2	2	2	0	0	19	21
South	33	16	3	14	362,180	171	140	2	3	0	8	13	3	9	1	29	42
Offshore	16	8	1	7	147,949	43		0	0	1	2	3	0	1	1	4	6
Michigan	8	5	0	3	25,106	44	56	0	0	0	1	1	1	0	0	12	13
Mississippi	8	4	0	4	58,348	47	31	0	0	0	4	4	4	0	0	17	21
Montana	4	3	0	1	33,888	35	31	0	0	0	1	1	1	0	0	10	11
Nebraska	16	7	0	9	87,983	69	47	0	0	0	8	8	1	0	0	36	37
New Mexico	36	18	9	9	214,759	172	76	3	0	1	8	12	6	0	3	16	25
Northwest	8	0	7	1	46,379	64	13	0	0	1	1	2	0	0	3	3	6
Southeast	28	18	2	8	168,380	108	63	3	0	0	7	10	6	0	0	13	19
North Dakota	5	3	0	2	40,616	17	14	0	0	0	1	1	0	0	0	4	4
Ohio	18	7	3	8	36,343	95	77	0	0	0	1	1	0	0	0	2	2
Oklahoma	227	150	8	69	799,065	721	578	8	0	1	21	30	16	5	2	64	87
Pennsylvania-New York	28	11	3	*14	48,018	37	139	0	0	0	0	0	0	0	1	0	1
Texas	434	277	19	138	1,837,853	1,614	1,443	15	0	3	86	104	71	6	16	368	461
Southwest (1 & 4)	44	20	3	21	185,091	233	201	1	0	1	14	16	15	2	4	72	93
Gulf Coast (2 & 3)	56	27	9	20	381,579	236	211	0	0	0	15	15	4	3	5	67	79
East (5 & 6)	16	8	0	8	67,032	92	98	0	0	0	6	6	0	1	1	35	37
North Central (7-B & 9)	180	95	1	84	558,248	583	460	12	0	0	47	59	37	0	1	136	174
West (7-C & 8)	98	93	3	2	507,417	376	386	2	0	2	2	6	15	0	4	54	73
Panhandle (10)	40	34	3	3	138,486	94	87	0	0	0	2	2	0	0	1	4	5
Utah	1	0	0	1	5,912	3	5	0	0	0	1	1	0	0	0	2	2
West Virginia	3	1	2	0	10,138	31	50	0	0	0	0	0	0	0	0	0	0
Wyoming	17	5	1	11	79,513	74	84	0	0	1	5	6	1	0	3	27	31
Miscellaneous	0	0	0	0	0	9	3	0	0	0	0	0	0	0	0	1	1
Total United States	**1,185**	677	65	443	4,885,254	4,560	4,134	35	3	10	210	**258**	129	22	32	873	1,056
Total previous week	1,182	€29	105	448	4,680,461			31	4	8	197	240	94	19	22	663	798
Cumulative 1956	4,560	2,445	307	1,808	18,930,323												
Total January 29, 1955	968	544	68	356	3,963,803			32	2	10	164	208	109	11	33	730	883
Western Canada	45	33	1	11	226,341	169											

Service wells included: *13.

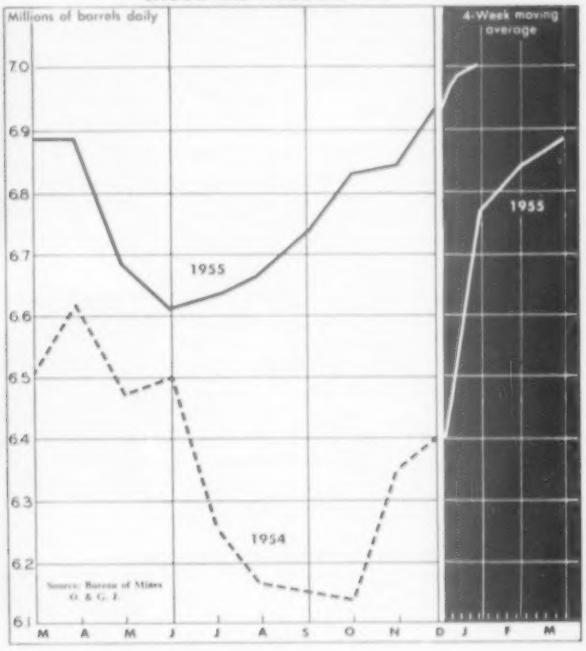
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



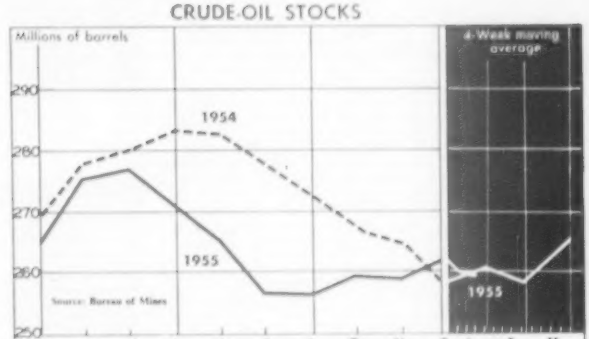
DAILY AVERAGE PRODUCTION FOR WEEK

	January 28			Jan. 21
	Crude oil	Lease condendate	Total	total
Alabama	4,300		4,300	4,000
Arkansas	72,000	500	72,500	72,750
California	978,800		978,800	979,700
Colorado	159,500		159,500	161,000
Eastern	49,200		49,200	48,500
Florida	1,350		1,350	1,350
Illinois	227,800		227,800	231,200
Indiana	30,100		30,100	31,300
Kansas	325,300		325,300	348,800
Kentucky	45,200		45,200	44,500
Louisiana	728,600	61,200	789,800	789,600
North	116,600	2,200	118,800	118,600
South	612,000	59,000	671,000	671,000
Michigan	29,700		29,700	31,400
Mississippi	106,000	5,350	111,350	111,350
Montana	41,100		41,100	41,600
Nebraska	29,000		29,000	28,600
New Mexico	227,900	3,900	231,800	231,600
North Dakota	41,300		41,300	38,200
Oklahoma	587,400		587,400	610,700
Texas	2,885,000	53,050	2,938,050	2,938,050
Dist. 1	48,000	650	48,650	48,650
Dist. 2	153,000	8,200	161,200	161,200
Dist. 3	428,000	25,000	453,000	453,000
Dist. 4	242,000	5,300	247,300	247,300
Dist. 5	46,000	550	46,550	46,550
Dist. 6	127,500	5,700	133,200	133,200
East Texas field	223,500		223,500	223,500
Dist. 7-B	150,000	50	150,050	150,050
Dist. 7-C	169,000	4,800	173,800	173,800
Dist. 8	1,010,000	2,000	1,012,000	1,012,000
Dist. 9	196,000	600	196,600	196,600
Dist. 10	92,000	200	92,200	92,200
Utah	6,100		6,100	5,700
Wyoming	282,900		282,900	281,400
Others	‡425		‡425	225
Total U. S.	6,858,975	124,000	**6,982,975**	7,031,525
Change from previous week, down			**48,550**	
Canada	†457,300		†457,300	†467,100

Total U. S. production January 1-January 28 196,014,700 bbl.
Same period last year (crude plus cond.) *189,071,100 bbl.

*Includes 3,159,100 bbl. condensate. †Week ended previous Monday. ‡S. D. 100, Nev. 300, Ariz. 25.

CRUDE-OIL STOCKS



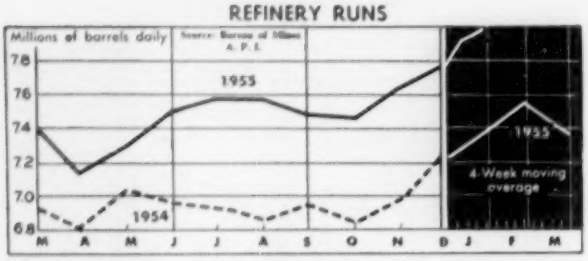
CRUDE-OIL STOCKS BY STATES OR ORIGIN*

(Thousands of barrels)

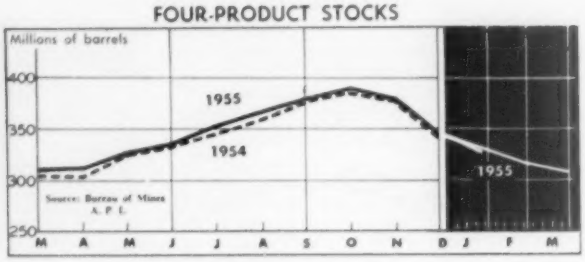
	1-21-56	1-14-56	1-22-55
Pennsylvania Grade	2,744	2,768	2,947
Other Appalachian	2,092	2,081	1,641
Illinois, Indiana, Michigan	9,055	9,217	10,642
Nebraska, North Dakota	2,171	1,987	1,917
Kansas	7,989	8,112	8,942
Oklahoma	21,478	21,816	25,081
Arkansas	2,068	2,003	2,915
Louisiana	15,809	15,717	14,303
North	2,683	2,664	2,315
South	13,126	13,053	11,988
Mississippi	3,098	3,105	3,104
New Mexico	7,811	7,933	7,726
Texas	123,783	123,437	118,010
East Texas proper	9,028	9,083	9,820
West Texas	58,206	58,062	50,567
Texas Gulf	24,419	24,934	24,718
Other Texas	32,130	31,358	32,905
Wyoming	15,850	15,674	14,616
Other Rocky Mountain	5,514	5,877	5,639
California	27,812	27,953	30,777
Foreign	†11,590	11,508	9,445
Total	258,864	259,188	257,705

*Bureau of Mines. †Includes 1,883,000 bbl. in California.

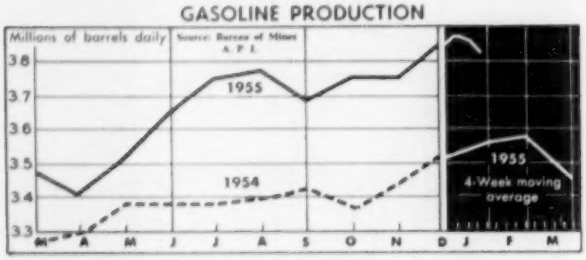
REFINERY RUNS



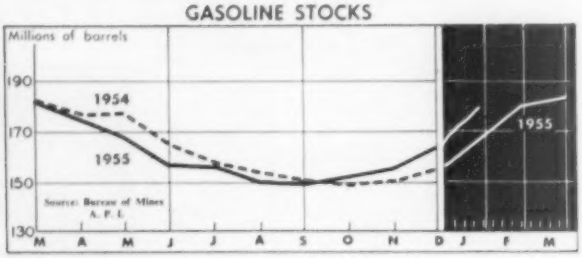
FOUR-PRODUCT STOCKS



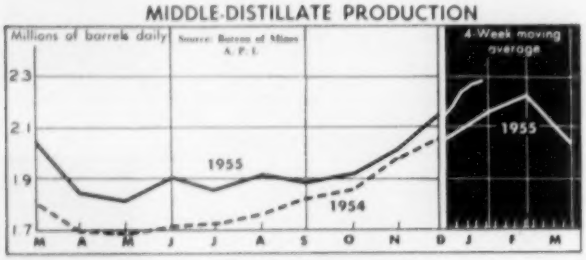
GASOLINE PRODUCTION



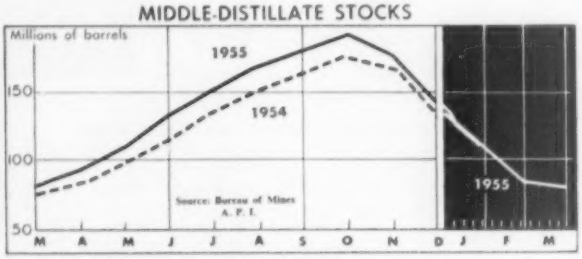
GASOLINE STOCKS



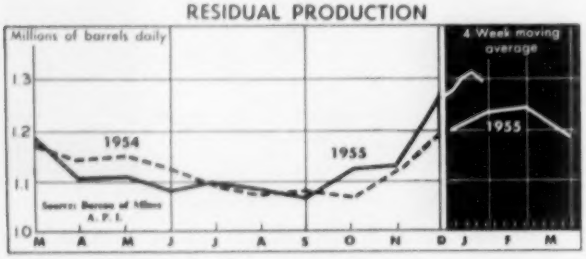
MIDDLE-DISTILLATE PRODUCTION



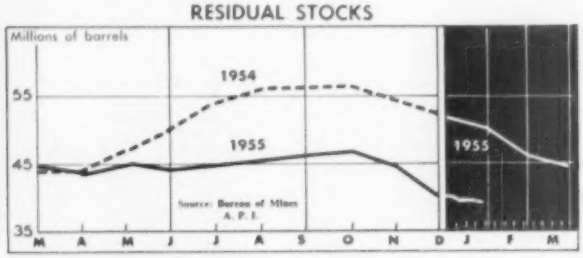
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JANUARY 27

(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, January 1955: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,158	480.7	48.4	289.4	248.2	35,892	8,929	30,830	10,646	1,151	454.5	40.7	313.5	234.7
Appalachian:														
District 1	103	42.4	7.1	28.6	10.3	4,652	540	1,815	497	104	43.1	6.3	24.6	8.6
District 2	107	48.3	7.0	19.6	19.4	2,606	331	571	293	92	43.7	7.9	15.2	15.3
Ind., Ill., Ky.	1,516	764.9	79.8	340.3	224.6	36,731	5,018	15,644	4,048	1,352	688.8	84.2	301.3	185.6
Okla., Kans., Mo.	759	449.1	18.6	209.6	29.9	20,527	978	9,339	1,022	678	393.0	17.3	159.3	50.5
Inland Texas	279	203.4	8.9	50.7	26.1	6,771	347	1,734	1,303	251	181.0	11.4	50.2	21.3
Texas Gulf Coast	1,874	880.0	135.8	523.1	240.2	26,614	2,229	10,070	6,574	1,798	814.5	148.0	487.2	235.0
La. Gulf Coast	704	268.3	59.9	171.0	60.7	9,909	1,645	4,475	1,397	622	298.8	70.2	142.4	51.0
N. La. and Ark.	97	31.9	9.9	22.8	8.7	4,060	1,900	1,550	68	95	35.7	9.7	19.6	7.0
Rocky Mountain:														
New Mexico	20	10.6		3.9	2.7	243	5	46	31	20	12.3	0.6	3.0	2.8
Other Rocky Mtn.	268	125.3	4.4	65.7	41.1	6,776	262	2,468	804	262	127.2	4.9	64.1	42.8
California	1,172	474.0	6.9	176.7	350.4	24,166	308	10,619	11,668	1,056	464.7	7.3	159.1	380.1
Jan. 27, 1956	8,058	3,778.9	386.7	1,901.4	1,262.3	178,947	21,592	89,161	38,351	7,481	3,557.3	408.5	1,739.5	1,234.7
Jan. 20, 1956	7,952	3,795.1	375.3	1,939.3	1,331.0	175,785	22,711	94,610	39,012					
Jan. 28, 1955	7,402	3,506.6	389.1	1,702.9	1,195.6	169,612	24,532	89,032	48,537					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (86 octane)	11.00-11.25
Premium (94 octane)	12.50-12.75
Gulf Coast (Cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.25
Premium (97 octane)	13.00-13.25
New York (barges):	
Regular (89 octane)	12.25
Premium (96 octane)	14.50
California—Los Angeles (rack):	
Regular (84 octane)	13.10-13.15
Premium (93 octane)	14.10-15.10
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	5.5
Breckenridge:	
Grade 26-70	5.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	10.25-10.375
★ Diesel oil (58 d.i. and above)	9.875-10.00
★ Distillate No. 1	9.875-10.00
★ Distillate No. 2	9.25-9.375
Gulf Coast (cargoes):	
Kerosine 41-43	9.5-9.625
Distillate No. 2	9.00-9.25
New York Harbor (barges):	
Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65
Caribbean area (cargoes):	
Distillate No. 2	9.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.10

★ Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.10-2.20
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined 0-10 p.p., 95 v.i.	23
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	19.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22-23
200 vis. neutral (180 at 100°), 25 p.t.	20

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M. (sour)	Wyo.
14-14.9	$1.97				
15-15.9	2.03				
16-16.9	2.09				
17-17.9	2.15				
18-18.9	2.21				
19-19.9	2.27				
20-20.9	2.33	$2.50		$2.37	
21-21.9	2.39	2.52		2.39	
22-22.9	2.45	2.54		2.41	
23-23.9	2.51	2.56		2.43	
24-24.9	2.57	2.58	$2.91	2.45	
25-25.9	2.63	2.60	2.93	2.47	
26-26.9	2.69	2.62	2.95	2.49	
27-27.9	2.76	2.64	2.97	2.51	
28-28.9	2.83	2.66	2.99	2.53	
29-29.9	2.91	2.68	3.01	2.55	
30-30.9	2.97	2.70	3.03	2.57	
31-31.9	3.04	2.72	3.05	2.59	$2.46
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9		2.76	3.09	2.63	2.50
34-34.9		2.78	3.11	2.65	2.52
35-35.9		2.80	3.13	2.67	2.54
36-36.9		2.82	3.15	2.69	2.56
37-37.9		2.84	3.17	2.71	2.58
38-38.9		2.86	3.19	2.73	2.60
39-39.9		2.88	3.21	2.75	2.62
40 and up		2.90	3.23	2.77	2.64

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas, and Wyoming (sweet). †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, October 17, 1955; east of California, June 15, 1953; Pennsylvania Grade, December 1, 1955.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	†3.85
Middle District	†3.72
Southwest Pennsylvania	†3.43
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Buckeye Grade	†3.25
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Illinois Basin	3.00
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Redwater (Alta.) D-3	2.49
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Fosterton (Sask.)	1.29
Pembina	2.52

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Venezuela:	
Cumarebo, 48°-48.9°, Tucupido	*$3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
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Tia Juana medium, 26.5°-26.9°, Amuay	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

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Arabian, 36.0°-36.9°, Ras Tanura	1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.92
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.39
Iraq, 36.0°-36.9°, Tripoli, Banias	2.39
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

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BOX J-330,
THE OIL AND GAS JOURNAL,
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BOX J-352, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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MANAGER for Calgary based subsidiary of established independent. Must be aggressive, capable of coordinating existing exploration and development program, with experience negotiating contracts. Permanent position for qualified man. In reply give past employment record, educational background and references. State salary requirements. All replies held confidential. Box J-333, The Oil and Gas Journal, Tulsa, Oklahoma.

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For responsible staff positions in New York Office directing the work of groups of experienced engineers doing process evaluation and design, economic studies and related work on refining and crude oil handling facilities, together with supporting power plants and other utilities. Work entails occasional trips of short duration to Europe and Middle East. Chemical Engineering degree plus 5 years' process experience, preferably in petroleum.

Salary commensurate with training and work experience. Liberal benefit program. Write giving full particulars regarding personal history and work experience. Please include telephone number.

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Experienced Graduate Geologist

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Experienced Graduate Engineer for work on products pipe line now in operation.

Positions are in Colombia
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GEOLOGICAL ENGINEER—Four years sub-surface mapping, evaluation, well siting—Gulf Coast and South Texas; Age 32. Desires position with independent having active drilling and development program. Resume sent on request. Box J-341, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

INSTRUMENT Department Supervisor desires responsible position in the instrumentation field. Qualified in measurement and control of flow, temperature, pressure, liquid level, pH, conductivity. Several years experience. College graduate. Please write to Box J-339, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL ENGINEER—38, registered, fourteen years Midcontinent experience. Desires employment with sound oil or uranium company. Box J-340, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMIC PARTY CHIEF for seven years Texas, Canada, Rockies desires supervisory or foreign assignment; proficient manager and interpreter. Box J-354, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER, 32, married, family. Seven years major company experience. Workovers, well completions and all phases of waterflooding. Employed. Box J-338, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER, 29, married, 2 years laboratory, 1 year diversified refining experience. Desires process or operations work. Box J-342, The Oil and Gas Journal, Tulsa, Oklahoma.

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Former U. S. and foreign refinery manager, engineering-construction executive, wishes locate Caracas or Bogota, Colombia representing U. S. oil equipment manufacturer or other company serving petroleum industry. Top level sales and administrative ability foreign operations. Box J-357, The Oil and Gas Journal, Tulsa, Oklahoma.

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MAILING LISTS

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SIX ROOM HOUSE for sale, Wichita, Kansas. North of Crestview Country Club. $35,000. Box J-351, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

WANTED: Producing royalties. Send report and full information to: C. A. Awalt, 511 Century Building, Fort Worth, Texas.

OIL PROPERTIES WANTED. "Oil properties wanted, settled or semi-settled production of 100 to 2,500 barrels daily in Oklahoma and Kansas. Property must stand thorough inspection. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma with particulars.

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LEASE AND DRILLING BLOCKS

CONTACT A L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Production.

WILL LEASE my West Texas land for oil or uranium prospecting. Box 419, Upland, California.

OWN 460 ACRES in South eastern Kansas. Want someone to drill. E. A. Tanquary, P. O. Box 97, Stanley, Kansas. Phone Olathe 2146W4.

6,000 ACRES under good lease in Forest City Basin S.W. Iowa. Excellent Geology. Will assign leases to reliable drilling firm for small override. Action before July 1, 1956. R. A. Trygg, Ogden, Iowa.

CAPITAL WANTED to drill shallow wells in oil seepage areas or will sell leases. Contact E. A. Munyan, 102 Fairview Drive, Fairfax, Va.

WANTED—Farm out or acreage to drill on in western part of Kentucky. Box J-356, The Oil and Gas Journal, Tulsa, Oklahoma.

CHOICE URANIUM PROPERTIES and other minerals available. GENERAL MINING COMPANY. Uranium—Minerals—Petroleum—Exploration—Development. Geological and Engineering Surveys. 144 N. Market St. P. O. Box 55, Phone 278, Cortez, Colo.

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The Oil and Gas Journal,
Tulsa, Oklahoma

CUBA THE NEW OIL COUNTRY

What would you like to know about Cuba's oil possibilities? Book containing recapitulation of geological reports; geological and structural maps, map of actual producing fields; map of the whole Island showing claims and concessions held by majors and independents; Mineral Fuel Law including 100% tax exemptions; statistics of national production and crude imported; names and addresses of active companies, and several reports, will be out of press Feb. 25th. Price $75.00—Refundable if not satisfied. Orders to M. A. Noguera, Aguiar 574 St. Havana, Cuba. Phone A-3540.

LEASE AND DRILLING BLOCKS

FOR SALE—⅛ interest in quarter section #26, Pawhuska, Okla. One well in. Box J-353, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING BLOCK, 2559 acres on Texas and New Mexico State line. For sale or drilling deal. Box J-355, The Oil and Gas Journal, Tulsa, Oklahoma.

KANSAS WATER FLOOD: 900 acres near Chanute, 2 oil wells, 2 injection wells, 600 ft. depth, pressure pumps, tanks etc. Sell or take partner. (Owner) O'Chamis, 10863 Bluffside Drive, No. Hollywood, Calif.

WILL FARM OUT to operators familiar with shallow production 200 acres near LaCygne, Kansas. 200' depth, 8000 bbls., according core drilling per acre. 31 gravity. 12 wells not operating now. Percentage deal. E. A. Mabes & Co., Inc. Commerce Bldg., Kansas City, Missouri.

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EDWIN J. BARTH
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BUSINESS OPPORTUNITIES

AS AN ENGINEER I am constantly contacting owners of oil and gas properties for sale. Have some excellent deals now in East Texas and Louisiana. Taylor Suite, 618 Kilgore Hotel, Kilgore, Texas.

NEED PARTNER with $300 to finance development of ten uranium claims on 50-50 basis. Good Assay. Write for details and map. Box 162, Heavener, Oklahoma.

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1. Companies with Production
2. Producing Properties

For Cash or Stock in Listed Company or Combination of Both.

All replies strictly confidential.

Box J-346,

The Oil and Gas Journal,
Tulsa, Oklahoma.

Equipment Men

Homco Opens Canadian Office at Edmonton

H. N. JOHNSON

Houston Oil Field Material Co., Inc., has recently opened operations in Canada with offices at Edmonton, Alta. Hoyt N. Johnson of Casper, Wyo., is in charge of operations in that area. Personnel operating in the Canada area under Johnson are: Buddy Pylate, fishing tool supervisor; William Ottenhouse, field engineer; Drew Almond, string shooting supervisor; Carl Orth, fishing tool supervisor; Harold Streit, directional drilling engineer.

Shannon Is Vice President Walter Kidde Southwest

G. T. SHANNON

Walter Kidde Constructors, Inc., engineers and builders of New York and Houston, has elected Gerard T. Shannon vice president of Walter Kidde Engineers Southwest, Inc., a division of parent company with headquarters in Houston, it was announced by William Collins, president of Walter Kidde Constructors.

Shannon joined Walter Kidde Constructors in 1953 as managing engineer for the company's industrial engineering department. He has had extensive experience in plant design, construction and operation with companies such as Monsanto Chemical Co., Stock Construction Corp., The Port of New York Authority, Frederick Snare Corp., and S. A. Healy Co.

In addition to his new duties, Shannon will continue as general manager of the southwest office of Walter Kidde Constructors and will report to E. Warren Bowden, vice president.

Pyrene, C-O-Two Announce Merger and Change Name

Solomon R. Baker, chairman of the board and president of Pyrene Manufacturing Co. and its wholly owned subsidiary, C-O-Two Fire Equipment Co., has announced a merger of the two companies and the adoption of a new name, Pyrene-C-O-Two Corp. This corporate merger has been preceded by unification of research, engineering, manufacturing, sales, and most administrative functions over the past year.

The company's general offices and main plant are in Newark and other plants and offices are in Chicago and Los Angeles. Additional sales and engineering offices are in Atlanta and Dallas.

Pyrene, established in 1907, produces principally vaporizing liquid, soda acid, water, and chemical-foam fire extinguishers, and air-foam fire-extinguishing systems. C-O-Two, established in 1925 and affiliated with Pyrene in 1933, produces carbon dioxide and dry chemical fire extinguishers and fire-extinguishing systems, as well as smoke and heat fire detecting system. The new corporation will continue the Pyrene and C-O-Two brand names.

Empire Machinery Boosts Sisson and Bills

Harris Sisson has been appointed vice president and sales manager of all sales activities, and C. E. Bills has been named vice president and assistant general manager of operations for Empire Machinery Co. of Odessa, Tex.

For the past 10 years Sisson has been active in all phases of the company and has had wide experience in the service and supply business in the Permian basin. Prior to joining Empire, Sisson was connected with National Supply Co. for several years.

Previous to this appointment, Bills was on the executive staff of Parkersburg Rig & Reel Co. as manager of systems planning. Prior to his service with Parkersburg, he was on the executive staff for Dresser Industries, Inc.

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F.L.A.* (Fluid Loss Additive), a petroleum derivative exclusive with Dowell, substantially lowers fluid loss when added to your fracturing medium. F.L.A. forms a film on the formation face to prevent fluid loss. This promotes longer fractures and deeper sand penetration. It means greater production and slower decline for your well.

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For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. B11.

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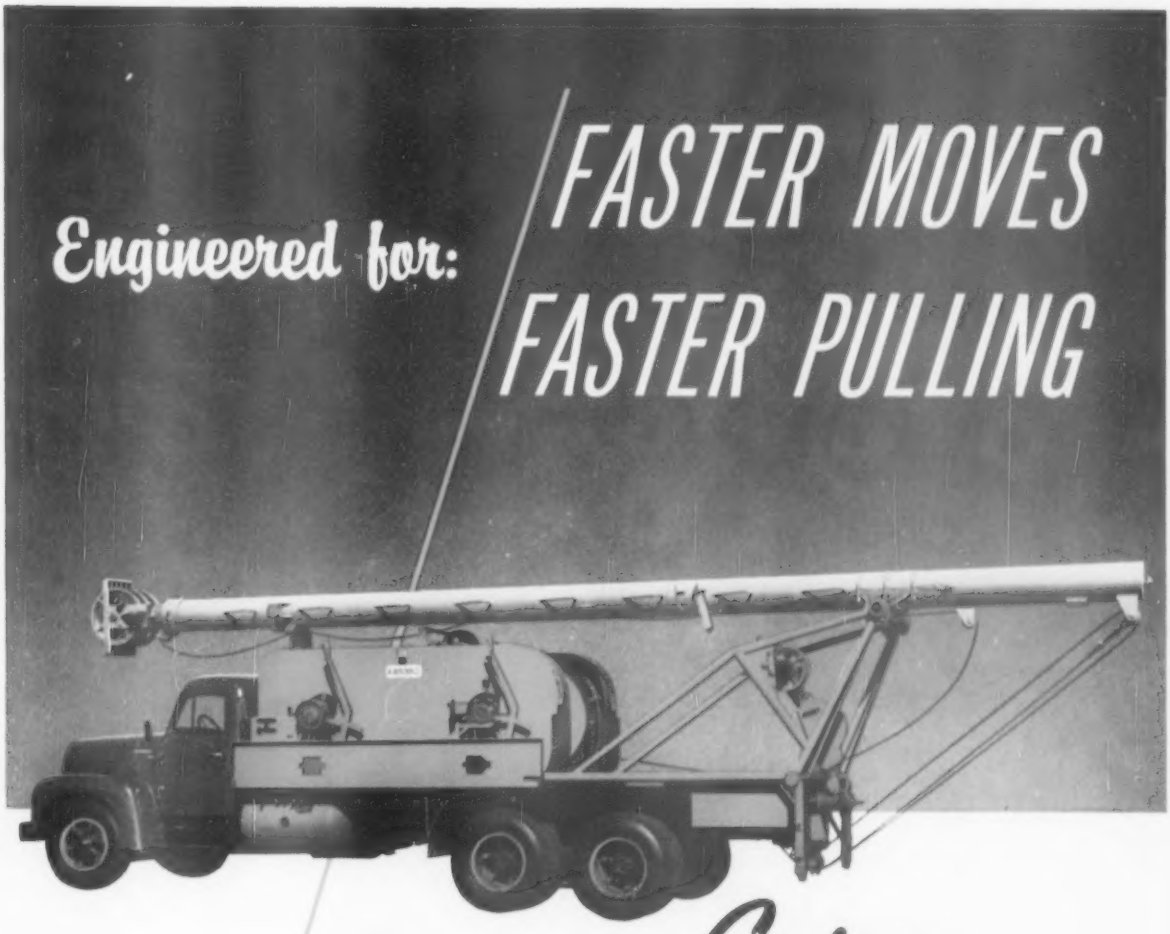

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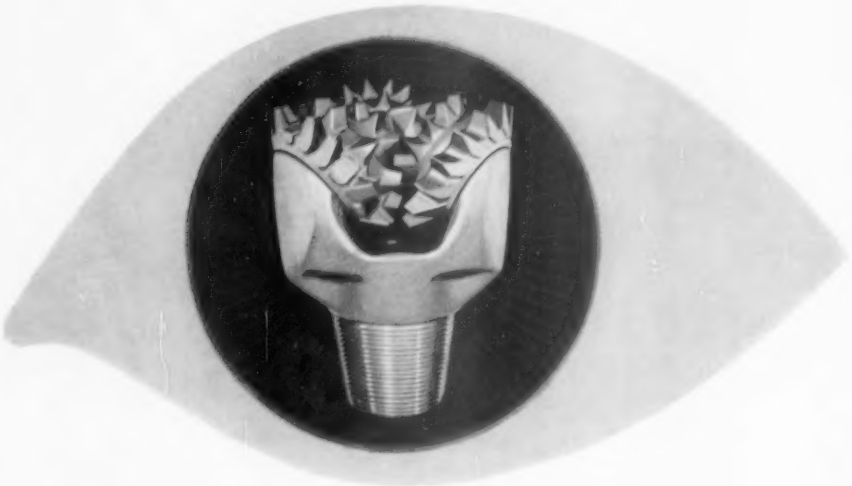

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